9.
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22. [illegible] BLAKE'S [illegible] GO[illegible]
JEAFFRESON. 2s.
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BY

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PREFACE.

In the preparation of this edition of Walkingame's Tutor's Assistant I have, for the most part, followed Mr. Walkingame's own method, except where it was incorrect or had become obsolete.

The chief alterations that I have ventured to make will be found in the sections on Simple and Compound Proportion—in the Commercial and other Examples, which I have adapted to the wants and customs of the present day—and in the sections on Circulating Decimals, Stocks, and Foreign Exchanges, which I have entirely re-written.

The whole has been subjected to a very careful revision.

E. Lethbridge, M.A.

5, Brick Court, Temple.

David Pinney
his Book
April 28 1858

CONTENTS.

EXPLANATION

OF THE

Characters made Use of in this Treatise.

$=$ *Equal to*	The Sign of Equality; as, 4 qrs. $=$ 1 cwt. signifies that 4 qrs. are equal to 1 cwt.
$-$ *Minus or less*	The Sign of Subtraction; as, $8-2=6$; that is, 8 less 2 is equal to 6.
$+$ *Plus or more*	The Sign of Addition; as $4+4=8$; that is, 4 added to 4 is equal to 8.
$\times$ *Multiplied by*	The Sign of Multiplication; as, $4\times 6=24$; that is, 4 multiplied by 6 is equal to 24.
$\div$ *Divided by*	The Sign of Division; as, $8\div 2=4$; that is, 8 divided by 2 is equal to 4.
$\frac{2357}{63}$	Numbers placed like a fraction likewise denote division; the upper number being the dividend, and the lower the divisor.
: *Is to* :: *so is* : *to*	The Signs of Proportion; as, 2 : 4 :: 8 : 16; that is, as 2 is to 4 so is 8 to 16.
$7-2+5=10$	Shows that the difference between 7 and 2 added to 5 is equal to 10.
$9-\overline{2+5}=2$	Signifies that the sum of 2 and 5 taken from 9 is equal to 2. *A line over any number of figures implies that they must be taken together, or the last characters would read thus,* 9 *minus* 2 $=$ 7 *plus* 5 *equal to* 12.
$\surd$	Prefixed to any number signifies the Square Root of that number.
$\sqrt[3]{}$	Signifies the Cube Root.
$\sqrt[4]{}$	Denotes the Biquadrate, or fourth Root.

ERRATUM.

Page 46, twelve lines from bottom, *for* $2\frac{17}{18}$ *read* $2\frac{77}{90}$.

THE TUTOR'S ASSISTANT;

BEING A

COMPENDIUM OF ARITHMETIC.

THE INTRODUCTION.

ARITHMETIC is the Art or Science of computing by Numbers, and has five principal or fundamental Rules upon which all its operations depend—viz., NOTATION *or* NUMERATION, ADDITION, SUBTRACTION, MULTIPLICATION, and DIVISION.

Numbers are expressed by the combination of certain characters or figures—viz., 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, which signify respectively *Zero* or *nothing*, *one*, *two*, *three*, *four*, *five*, *six*, *seven*, *eight*, *nine*.

NOTATION teaches how to form combinations of these figures so as to express any given number.

NUMERATION teaches the value of any such combinations.

NUMERATION TABLE.

Millions.			Thousands.			Units.		
Hundreds of	Tens of	Single Ones of	Hundreds of	Tens of	Single Ones of	Hundreds of	Tens of	Single Ones of
9	8	7	6	5	4	3	2	1
9	0	0	0	0	0	0	0	0
	8	0	0	0	0	0	0	0
		7	0	0	0	0	0	0
			6	0	0	0	0	0
				5	0	0	0	0
					4	0	0	0
						3	0	0
							2	0
								1

RULE.—There are three periods; the first (on the right hand of the table), units; the second, thousands; and the third, millions; each consisting of three figures or places. Reckon the first figure of each from the left hand, as so many

Hundreds, the next as so many Tens, and the third as so many single Ones of what is written over them. Thus above, the first period on the left hand is read—Nine hundred eighty-seven millions; and so on for the rest.

Write down in proper figures the following Numbers:

Twenty-three; two hundred and fifty-four; three thousand two hundred and four; twenty-five thousand, eight hundred and fifty-six; one hundred thirty-two thousand, two hundred forty-five; four millions, nine hundred forty-one thousand, four hundred; twenty-seven millions, one hundred fifty-seven thousand, eight hundred thirty-two; seven hundred twenty-two millions, two hundred thirty-one thousand, five hundred and four; six hundred two millions, two hundred ten thousand, five hundred.

Write down in Words at length the following Numbers:

35	2017	519007	5207054	65700047
59	5201	754058	2071909	900061057
172	20760	5900030	70054008	221900790

NOTATION BY ROMAN LETTERS.

I	One	XXX	Thirty
II	Two	XL	Forty
III	Three	L	Fifty
IV	Four	LX	Sixty
V	Five	LXX	Seventy
VI	Six	LXXX	Eighty
VII	Seven	XC	Ninety
VIII	Eight	C	Hundred
IX	Nine	CC	Two hundred
X	Ten	CCC	Three hundred
XI	Eleven	CCCC	Four hundred
XII	Twelve	D	Five hundred
XIII	Thirteen	DC	Six hundred
XIV	Fourteen	DCC	Seven hundred
XV	Fifteen	DCCC	Eight hundred
XVI	Sixteen	DCCCC	Nine hundred
XVII	Seventeen	M	One thousand
XVIII	Eighteen	MDCCCLXVI	One thousand eight hundred and sixty-six
XIX	Nineteen		
XX	Twenty		

ADDITION

TEACHES how to add two or more numbers together, to make one whole or total number, called the *Sum*.

RULE.—Care must be taken in placing the figures one under the other, so that the units-figure may come under the units-figure, the tens under the tens, and so on. Then add up the first row of units from the bottom to the top; set down the units-figure of the number thus found under the units-row; and carry on the tens-figure to the tens-row, and so on, continuing to the last row, at which set down its total amount.

PROOF.—Begin at the top of the sum, and reckon downwards; if the result is the same as before, the sum is supposed to be right.

EXAMPLES.—I.

(1)	(2)	(3)	(4)
275	1234	75245	271048
110	7098	37502	325476
473	3314	91474	107584
354	6732	32145	625608
271	2548	47258	754087
352	709	21476	279736

(5) What is the sum of 43, 401, 9747, 3464, 2263, 314, 974? *Ans.* 17206

(6) Add together 246034, 298765, 47321, 58653, 64218, 5376, 9821, and 640. *Ans.* 730,828

(7) If you give A £56, B £104, C £274, D £391, E £703, how much is given in all? *Ans.* £1528

(8) How many days are there in the twelve calendar months? *Ans.* 365

SUBTRACTION

TEACHES how to find the difference between two numbers, *i.e.*, the remainder when the less is taken from the greater.

RULE.—Place the less under the greater number, taking care that the figures are in their right places, as in addition.

Then, beginning with the units-figures, subtract the lower figure from the upper, and set down the remainder under that row, and so on. If the lower figure is greater than the upper, add 10 to the latter, set down the remainder now, and add (or *carry*) 1 to the lower figure in the next row; and so on.

PROOF.—Add the remainder and the less line together, and the result should be the same as the greater line.

EXAMPLES.—II.

From	(1) 271	(2) 4754	(3) 42087
Take	154	2725	34096
Remainder	117		
Proof	271		
From	(4) 452705	(5) 271508	(6) 3750215
Take	327616	152471	3150874

(7) From 96 thousand and twenty take 5701.

Ans. 90319.

MULTIPLICATION

TEACHES how to increase a given number (called the *Multiplicand*) to as many times its original magnitude as there are units in another number (called the *Multiplier*). The result is the *Product* of the two numbers.

RULE.—Begin with the figure that stands in the units place of the multiplier, and multiply with it the first figure of the units place of the multiplicand. Set down the units, and carry the tens in mind till you have multiplied the next figure in the multiplicand by the same figure in the multiplier; to the product of which add the tens you kept in mind, setting down the units; and proceed as before till the whole line is multiplied.

PROOF.—Make the former multiplicand the multiplier, and the multiplier the multiplicand; the result should be the same as before.

MULTIPLICATION TABLE.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

EXAMPLES.—III.

Multiplicand	(1) 25104736	(2) 52471021	(3) 7925437521
Multiplier	2	3	4
Product	50209472		

(4) 27104107 × 5 (5) 231047 × 6 (6) 7092516 × 7
(7) 3725104 × 8 (8) 4215466 × 9 (9) 2701057 × 10
(10) 31040171 × 11 (11) 698854 × 12

When the Multiplier is more than 12 *and less than* 20,

Multiply the multiplicand by the units figure in the multiplier, and add the back figure to the product, of which put down the units, and carry the tens to the next; repeat the same through the line, adding the last tens to the last figure in the multiplicand.

EXAMPLES.—IV.

Multiply (1) 4710572
By 13

Product 61237436

(2) 5107252 × 14 (5) 6653210 × 15
(3) 9205716 × 16 (6) 6251721 × 17
(4) 9215324 × 18 (7) 2571341 × 19

When the Multiplier consists of several figures,

There must be as many products as there are figures in the Multiplier. Be careful to place the first figure of every product under the figure you are multiplying by. Add the several products thus together, and their sum will be the total product.

EXAMPLES.—V.

(1) 271041071 × 5147 (2) 62310047 × 1608
(3) 170925164 × 7419 (4) 9500985472 × 61879

When ciphers are among the figures in the Multiplier,

They may be omitted in the working; but great care must be taken in placing the first figure of the next product as many places further to the left hand as there are ciphers omitted.

EXAMPLES.—VI.

(1) 7561240325 × 57002 (2) 562710934 × 59003

When ciphers are at the end of the Multiplicand or Multiplier, or both,

They may be omitted in the working, but the number of ciphers that were left out must be placed on the right hand of the total product.

EXAMPLES.—VII.

(1) 7271000 × 52600 (2) 7483700 × 975000

When the Multiplier is compounded of two or more single figures multiplied together,

Multiply by one of these figures, and the product by the next, and so on, and the final product will give the answer.

EXAMPLES.—VIII.

(1) 921563 × 32 (2) 715241 × 56

DIVISION

TEACHES how often one number (called the *Divisor*) is contained in another (called the *Dividend*). The answer is called the *Quotient*.

RULE.—*When the Divisor does not exceed* 12,

Find how often it is contained in the first figure of the dividend; or if the first figure be less, take two figures; set down the number, and carry the overplus (if any) to the next in the dividend *as so many tens;* then find how often the divisor is contained therein, set it down, and continue the same through the line; if any number is over, it is called the remainder.

PROOF.—Multiply the quotient by the divisor, add the remainder, and the result ought to be the same as the dividend.

EXAMPLES.—IX.

(1) 725107 ÷ 2 (2) 759654 ÷ 4 (3) 523103 ÷ 6
(4) 720387 ÷ 7 (5) 2547325 ÷ 8 (6) 5906308 ÷ 11

When the Divisor is a composite number,

Find what two numbers, being multiplied together, make the number; then divide the dividend by either of them, and that quotient by the other. This will give the quotient required. If there be a remainder to the first line, and none to the second, that remainder is the true one; but when there is a remainder to the second line, the true remainder is thus found.

RULE.—Multiply the first divisor into the last remainder, and to that product add the first remainder (if any).

EXAMPLES.—X.

(1) 310473 ÷ 27 (2) 7210486 ÷ 35
(3) 9174835 ÷ 56 (4) 9958748 ÷ 64

$$16\left\{\begin{array}{l}2)89347397\\ \hline 8)44673698\text{—}1\\ \hline 5584212\text{—}2\end{array}\right\}5 \text{ Remr.}$$

When the Divisor exceeds 12, *and is not a composite number*, Find how many times the divisor is contained in an equal number of figures on the left hand of the dividend; but if the first figure of the divisor be larger than the first in the dividend, take one figure more, and place the number of times in the quotient.

Multiply the divisor by the quotient figure, and place the product under the dividend; subtract one from the other, and bring down the next figure in the dividend, place it after the remainder, and proceed as before.

When the figure is so brought down, and the remainder is then less than the divisor, place a cipher in the quotient, and bring down another, or as many more as may be found requisite, till it will divide, remembering to put a cipher in the quotient for each so brought down; continue in the same manner until the whole is done.—PROOF, as above.

EXAMPLES.—XI.

Divisor. Dividend. Quotient.

```
29)4172377(143875
   29
  ---
   127
   116
  ---
    112
     87
    ---
    .253
     232
    ---
    .217
     203
    ---
    .147
     145
    ---
Remr. .2
```

```
   29
 -----
 1294875
  287750
        2 Rem.
 -------
 4172377 Proof.
```

(1) Div. 7210473 by 37
Ans. $194877\frac{24}{37}$

(2) Div. 42749467 by 347

(3) Div. 734097143 by 5743

(4) Div. 1610478407 by 54716

(5) Div. 4973401891 by 510834

(6) Div. 51704567874 by 4765043

(7) Div. 17453798946123741 by 31479461

When there are ciphers at the end of the Divisor, they may be cut off; and as many places from off the Dividend, which must be annexed to the Remainder at last.

EXAMPLES.—XII.

(1) 271|00)254732|21(939
(2) 5721|00)7253472|16(1267
(3) 273|000)752473|729(2756
(4) 215|000)6325104|997(29419

TABLES OF MONEY, WEIGHTS, AND MEASURES.

MONEY.

Marked			Marked
¼	Farthing.	4 Farthings make 1 Penny -	*d.*
½	Halfpenny.	12 Pence — 1 Shilling -	*s.*
¾	Three Farthings.	20 Shillings — 1 Pound -	£

Farthings.
4 = 1 Penny.
48 = 12 = 1 Shilling.
960 = 240 = 20 = 1 Pound.

SHILLINGS AND PENCE TABLE.

Shillings.		
s.	*l.*	*s.*
20 are	1	0
30 —	1	10
40 —	2	0
50 —	2	10
60 —	3	0
70 —	3	10
80 —	4	0
90 —	4	10
100 —	5	0

s.	*l.*	*s.*
110 are	5	10
120 —	6	0
130 —	6	10

Pence.		
d.	*s.*	*d.*
20 —	1	8
24 —	2	0
30 —	2	6
36 —	3	0

d.	*s.*	*d.*
40 are	3	4
48 —	4	0
50 —	4	2
60 —	5	0
70 —	5	10
72 —	6	0
80 —	6	8
84 —	7	0
90 —	7	6
96 —	8	0

d.	*s.*	*d.*
100 are	8	4
108 —	9	0
110 —	9	2
120 —	10	0
130 —	10	10
132 —	11	0
140 —	11	8
144 —	12	0
150 —	12	6
160 —	13	4

TROY WEIGHT.

			Marked
24 Grains	make 1 Pennyweight...		*gr.* / *dwt.*
20 Pennyweights	1 Ounce		*oz.*
12 Ounces	1 Pound		*lb.*

Grains.
24 = 1 Pennyweight.
480 = 20 = 1 Ounce.
5760 = 240 = 12 = 1 Pound.

By this weight are weighed gold, silver, jewels, electuaries, and all liquors.

25 lb. is a quarter of a cwt.—100 lb. 1 cwt.—20 cwt. 1 ton of gold or silver.

The standard for gold coin consists of 22 parts, or *carats*, of pure gold, and 2 *carats* of alloy; a carat being one-twenty-fourth part. In weighing diamonds, a carat is $3\frac{1}{6}$ grains.

AVOIRDUPOIS WEIGHT.

			Marked
16 Drams	make 1	Ounce	*dr.* *oz.*
16 Ounces	1	Pound	*lb.*
28 Pounds	1	Quarter	*qr.*
4 Quarters or 112 lb.	1	Hundred Weight	*cwt.*
20 Hundred Weight	1	Ton	*ton.*
$19\frac{1}{2}$ Hundred Weight	1	Fother	*foth.*

Drams.
16 = 1 Ounce.
256 = 16 = 1 Pound.
7168 = 448 = 28 = 1 Quarter.
28672 = 1792 = 112 = 4 = 1 Hundred Weight.
573440 = 35840 = 2240 = 80 = 20 = 1 Ton.

By this weight are weighed all metals, except gold and silver, and all commodities that are subject to waste; as groceries of every description, provisions in general, &c.

One pound avoirdupois is equal to 14 oz. 11 dwts. $15\frac{1}{2}$ grs. troy.

Silks are weighed, some 24 oz., others 16 oz. to the lb.

There are several other denominations in this weight that are used for particular goods, viz.:

	lb.		*lb.*
A firkin of butter	56	A stone of butcher's meat	8
——— soap	64	A gallon of train oil	$7\frac{1}{2}$
A barrel of anchovies	30	A puncheon of prunes	1120
——— soap	256	A truss of straw	36
——— raisins	112	——— new hay	60
A stone of iron shot, or horseman's weight	14	——— old hay	56
		Thirty-six trusses are a load.	

CHEESE AND BUTTER.

	lbs.
A clove, or half stone.....	8
A wey, in Suffolk, 32 cloves, or	256
A wey, in Essex, 42 cloves, or	336

WOOL.

	lbs.		*lbs.*
A clove	7	A wey, or $6\frac{1}{2}$ tods.....	182
A stone	14	A sack, or 2 weys	364
A tod	28	A last, or 12 sacks.....	4368

APOTHECARIES' WEIGHT.

				Marked
20 Grains.....	make	1	Scruple	*gr.* or ℈
3 Scruples	„	1	Dram.....	ʒ
8 Drams	„	1	Ounce	℥
12 Ounces.....	„	1	Pound	℔

Grains.			
20 =	1	Scruple.	
60 =	3 =	1	Dram.
480 =	24 =	8 =	1 Ounce.
5760 =	288 =	96 =	12 = 1 Pound.

Apothecaries, Druggists, and Chemists, compound medicines by this weight, but they buy and sell drugs by avoirdupois.

The Apothecaries' pound and ounce, and the pound and ounce troy, are the same, only differently divided and subdivided.

CLOTH MEASURE.

				Marked
$2\frac{1}{4}$ Inches.....	..make	1	Nail.....	*in.* or *n.*
4 Nails	„	1	Quarter	*qr.*
4 Quarters.....	„	1	Yard	*yd.*
3 Quarters.....	„	1	Flemish Ell.....	*F. E.*
5 Quarters.....	„	1	English Ell.....	*E. E.*
6 Quarters.....	„	1	French Ell	*Fr. E.*

Inches.

$2\frac{1}{4}$ = 1 Nail.
9 = 4 = 1 Quarter.
36 = 16 = 4 = 1 Yard.
27 = 12 = 3 = 1 Flemish Ell.
45 = 20 = 5 = 1 English Ell.
54 = 24 = 6 = 1 French Ell.

LONG MEASURE.

				Marked
3	Barleycorns...make	1	Inch	*bar. cor.* / *in.*
12	Inches ..... ,,	1	Foot	*ft.*
3	Feet..... ,,	1	Yard	*yd.*
6	Feet..... ,,	1	Fathom	*fath.*
$5\frac{1}{2}$	Yards ..... ,,	1	Rod, pole, or perch .	*rod, p.*
40	Poles ..... ,,	1	Furlong.....	*fur.*
8	Furlongs ..... ,,	1	Mile	*mile.*
3	Miles ..... ,,	1	League	*leag.*
60	Miles ..... ,,	1	Degree	*deg.*

Barleycorns.

3 = 1 Inch.
36 = 12 = 1 Foot.
108 = 36 = 3 = 1 Yard.
594 = 198 = $16\frac{1}{2}$ = $5\frac{1}{2}$ = 1 Pole.
23760 = 7920 = 660 = 220 = 40 = 1 Furlong.
190080 = 63360 = 5280 = 1760 = 320 = 8 = 1 Mile.

A degree is $69\frac{1}{2}$ miles nearly, but in geography reckoned 60 miles. A mile is 1760 yards.

This measure is commonly used for length only, as distance of places, &c.

Horses are measured by the hand of 4 inches.

NOTE.—The mile in England contains 1760 yards, but its length varies in different countries—viz., in Russia, it is 1100 yards; in Italy, 1467; Scotland and Ireland, 2200; Poland, 4400; Spain, 5028; Germany, 5866; Sweden, 7233; Denmark, 7233; Hungary, 8800. In France they reckon by leagues; the small league is 2933 yards; the mean league, 3666; and the great league 4400.

WINE MEASURE.

				Marked
2	Pints	make 1	Quart	*pts.* / *qts.*
4	Quarts	„ 1	Gallon.....	*gal.*
10	Gallons.....	„ 1	Anchor of brandy	*anc.*
18	Gallons.....	„ 1	Runlet.....	*run.*
31½	Gallons.....	„ ½	Hogshead	*½ hhd.*
42	Gallons.....	„ 1	Tierce.....	*tierce.*
63	Gallons.....	„ 1	Hogshead	*hhd.*
2	Hogsheads	„ 1	Pipe or butt	*pipe, butt.*
2	Pipes or 4 hogsheads	1	Tun	*tun.*

By this measure all brandies, spirits, perry, cider, mead, vinegar, honey, and oil are measured.

Pipes vary considerably in quantity, according to the kinds of wine they contain, viz.—

Pipe of Madeira.....	110 gallons.
Ditto of Sherry	130 „
Ditto of Port	138 „
Ditto of Claret	126 „

ALE AND BEER MEASURE.

				Marked
2	Pints	make 1	Quart	*pts.* / *qts.*
4	Quarts	„ 1	Gallon.....	*gal.*
9	Gallons	„ 1	Firkin.....	*fir.*
2	Firkins	„ 1	Kilderkin	*kil.*
4	Firkins, or 2 kilderkins	„ 1	barrel	*bar.*
1½	Barrel, or 54 Gallons	„ 1	Hogshead of beer	*hhd.*
2	Barrels	„ 1	Puncheon	*pun.*
3	Barrels, or 2 hogsheads	„ 1	Butt	*butt.*

NOTE.—The *imperial gallon*, which is now by Act of Parliament the same for wine, ale, and beer, contains 10 pounds avoirdupois of distilled water; its cubic content is $277\frac{274}{1000}$ cubic inches.

N.B.—A barrel of salmon or eels is 42 gallons.
A barrel of herrings .....32 gallons.
A keg of sturgeon ..... 4 or 5 gallons.
A firkin of soap ..... 8 gallons.

DRY MEASURE.

			Marked
2 Pints	make	1 Quart.....	*pts.* *qts.*
2 Quarts	,,	1 Pottle	*pot.*
4 Quarts	,,	1 Gallon	*gal.*
2 Gallons	,,	1 Peck	*pk.*
4 Pecks	,,	1 Bushel	*bush.*
2 Bushels	,,	1 Strike	*strike.*
4 Bushels	,,	1 Coomb	*coomb.*
2 Coombs, or 8 bushels ...	,,	1 Quarter.....	*qr.*
5 Quarters.....	,,	1 Wey or Load	*wey.*
2 Weys	,,	1 Last.	*last.*

Solid Inches.

$268\frac{4}{5}$ = 1 Gallon.
$537\frac{3}{5}$ = 2 = 1 Peck.
$2150\frac{2}{5}$ = 8 = 4 = 1 Bushel.
$4300\frac{4}{5}$ = 16 = 8 = 2 = 1 Strike.
$8601\frac{3}{5}$ = 32 = 16 = 4 = 2 = 1 Coomb.
$17203\frac{1}{5}$ = 64 = 32 = 8 = 4 = 2 = 1 Quarter.
86016 = 320 = 160 = 40 = 20 = 10 = 5 = 1 Wey.
172032 = 640 = 320 = 80 = 40 = 20 = 10 = 2 = 1 Last.

This measure is so called, as it is used principally for all dry commodities, such as wheat, barley, and grain in general; sand, salt, fruit, oysters, &c.

A load of corn is 5 bushels; a cart load is 40 bushels.

The standard bushel is $18\frac{1}{2}$ inches diameter, and 8 inches deep.

NOTE.—The load of 5 bushels is a sack, and means a load for a man or a horse; the weight is about $2\frac{1}{2}$ cwt.

COALS.

3 Bushels	make	1 Sack.
12 Sacks, or 36 bushels...	,,	1 Chaldron.
21 Chaldrons	,,	1 Score.

In London coals are sold by weight.

TIME.

			Marked
60 Seconds	make	1 Minute	*sec.* / *m.*
60 Minutes	,,	1 Hour	*hour.*
24 Hours	,,	1 Day	*day.*
7 Days	,,	1 Week	*week.*
4 Weeks	,,	1 Month	*mo.*
13 Months, 1 day, 6 hours, or 365 Days, 5 ho., 48 min., 55 sec.		1 Year	*yr.*

Seconds.				
60 =	1 Minute.			
3600 =	60 =	1 Hour.		
86400 =	1440 =	24 =	1 Day.	
604800 =	10080 =	168 =	7 = 1 Week.	
2419200 =	40320 =	672 =	28 = 4 = 1 Month.	
31557600 =	525960 =	8766 =	365*d* 6*h* = 52*w* 1*d* 6*h* = 1 Year.	

Though the year is commonly reckoned 365 days 6 hours, it is accurately ascertained to contain 365 days, 5 hours, 48 minutes, and 55 seconds.

To know the Days in each Month.

Thirty days hath September,
April, June, and November;
February hath twenty-eight alone,
All the rest have thirty and one;
Except leap-year, and then's the time
February's days are twenty-nine.

To know when it is Leap-Year,

Divide the year by four, and if there be no remainder it is leap-year; but whatever figure is over, denotes the number of years since.

The Quarter Days are

Lady-day..... 25 March.
Midsummer-day ..... 24 June.
Michaelmas-day ..... 29 September.
Christmas-day ..... 25 December.

SQUARE AND LAND MEASURE.

				Marked
144	Inches	make 1	Foot	*in.* / *feet.*
9	Feet	,, 1	Yard	*yd.*
100	Feet	,, 1	Sq. of Flooring	*sq. flooring.*
$272\frac{1}{4}$	Feet	,, 1	Rod	*rod.*
40	Rods, Poles, or Perches	1	Rood	*rood.*
4	Roods, or 160 Rods, or 4840 Yards...	1	Acre of Land...	*acre of la.*
640	Acres	,, 1	Square Mile ...	*sq. mile.*
30	Acres	,, 1	Yard of Land...	*yd. land.*
100	Acres	,, 1	Hide of Land...	*hide of la.*

Inches.				
144 =	1 Foot.			
1296 =	9 =	1 Yard.		
39204 =	$272\frac{1}{4}$ =	$30\frac{1}{4}$ =	1 Pole.	
1568160 =	10890 =	1210 =	40 =	1 Rood.
6272640 =	43560 =	4840 =	160 = 4 =	1 Acre.

By this measure is measured whatever has length and breadth; such as land, painting, plastering, flooring, thatching, plumbing, glazing, &c.

Land is measured by a chain of 4 poles long, which is 22 yards, or 66 feet; and contains 100 links. Ten chains in length, and 1 in width, make an acre.

SOLID MEASURE.

				Marked.
1728	Cubic Inches ...	make 1	Cubic Foot.....	*cub. in.* / *cub. foot.*
27	Cubic Feet.....	,, 1	Cubic Yard, or Load of Earth	*cub. yd.* / *load of ear.*

TIMBER.

40 Feet of round Timber / Or 50 Feet of hewn Timber	1 Ton or Load.

By solid measure are measured timber, and whatever has length, breadth, and depth.

Boards of all widths are commonly sold by feet in length only, and not by square feet, unless so specified.

108 solid feet, *i.e.*, 12 feet in length, 3 in breadth, and 3 deep; or commonly, 14 feet long, 3 feet 1 inch broad, and 3 feet 1 inch deep, is a stack of wood.

128 solid feet, *i.e.*, 8 feet long, 4 feet broad, and 4 feet deep, is a cord of wood.

In geographical and astronomical calculations,

60	Seconds.....	make	1 Minute.
60	Minutes.....	„	1 Degree.
30	Degrees.....	„	1 Sign of the Zodiac.
12	Signs.....	„	1 Great Circle.

ADDITION OF MONEY, WEIGHTS, AND MEASURES.

Rule.—Add the first row or denomination together, as in integers, then divide the sum by as many of the same denomination as will make one of the next greater, setting down the remainder under the row added; carry the quotient to the next superior denomination; continue the same to the last row, which add as in simple Addition.

Proof.—Cut off the top line, and the total of the remaining lines added to the top line will be the same as the answer.

EXAMPLES.—XIII.

MONEY.

(1)			(2)			(3)			(4)		
£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
2	13	$5\frac{1}{2}$	27	7	2	35	17	3	75	3	7
7	9	$4\frac{1}{4}$	34	14	$7\frac{1}{4}$	59	14	$7\frac{1}{2}$	54	17	$1\frac{1}{2}$
5	15	$4\frac{1}{2}$	57	19	$2\frac{1}{4}$	97	13	$5\frac{1}{4}$	91	15	$4\frac{1}{4}$
9	17	$6\frac{1}{4}$	91	16	1	37	16	$8\frac{1}{4}$	35	16	$5\frac{3}{4}$
7	16	3	75	18	$7\frac{3}{4}$	97	15	7	29	19	$7\frac{1}{4}$
5	14	$7\frac{3}{4}$	97	13	5	59	16	$5\frac{1}{2}$	91	17	$3\frac{1}{4}$
39	6	$7\frac{1}{4}$									

(5)

£	*s.*	*d.*
257	1	$5\frac{1}{2}$
734	3	$7\frac{3}{4}$
595	5	3
152	14	$7\frac{1}{2}$
207	5	4
798	16	$7\frac{3}{4}$

(6)

£	*s.*	*d.*
525	2	$4\frac{1}{4}$
179	3	5
250	4	$7\frac{1}{4}$
975	3	$5\frac{1}{4}$
254	5	7
379	4	$5\frac{3}{4}$

(7)

£	*s.*	*d.*
21	14	$7\frac{1}{4}$
75	16	0
79	2	$4\frac{1}{4}$
57	16	$5\frac{1}{2}$
26	13	$8\frac{3}{4}$
54	2	7

(8)

£	*s.*	*d.*
73	2	$1\frac{1}{2}$
25	12	$7\frac{1}{2}$
96	13	$5\frac{1}{4}$
76	17	3
97	14	1
54	11	$7\frac{1}{4}$

(9)

£	*s.*	*d.*
127	4	$7\frac{1}{2}$
525	3	5
271	0	5
524	9	1
379	4	$3\frac{1}{2}$
215	5	$8\frac{3}{4}$

(10)

£	*s.*	*d.*
261	17	$1\frac{1}{4}$
379	13	5
257	16	$7\frac{3}{4}$
184	13	5
725	2	$3\frac{1}{4}$
359	6	3

(11)

£	*s.*	*d.*
31	1	$1\frac{1}{2}$
75	13	1
39	19	$6\frac{1}{4}$
97	17	$3\frac{1}{4}$
36	13	5
24	16	$3\frac{1}{4}$

(12)

£	*s.*	*d.*
27	13	5
16	12	$9\frac{1}{4}$
9	13	3
13	2	$7\frac{1}{2}$
37	19	1
56	19	$1\frac{3}{4}$

TROY WEIGHT.

(13)

oz.	*dwt.*	*gr.*
5	11	4
7	19	21
3	15	14
7	19	22
9	18	15
8	13	12

(14)

lb.	*oz.*	*dwt.*
7	1	2
3	2	17
5	1	15
7	10	11
2	7	13
3	11	16

(15)

lb.	*oz.*	*dwt.*	*gr.*
5	2	15	22
3	11	17	14
3	7	15	19
9	1	13	21
3	9	7	23
5	2	15	17

AVOIRDUPOIS WEIGHT.

(16)			(17)			(18)			
lb.	*oz.*	*dr.*	*cwt.*	*qr.*	*lb.*	*t.*	*cwt.*	*qr.*	*lb.*
152	13	15	25	1	17	7	17	2	12
272	14	10	72	3	26	5	5	3	14
303	15	11	54	1	16	2	4	1	17
255	10	4	24	1	16	3	18	2	19
173	6	2	17	0	19	7	9	3	20
625	13	13	55	2	16	8	5	1	24

APOTHECARIES' WEIGHT.

(19)				(20)				
℔	℥	ʒ	℈	℔	℥	ʒ	℈	*gr.*
17	10	7	1	7	2	1	0	12
9	5	2	2	3	1	7	1	17
27	11	1	2	9	10	2	0	14
9	5	6	1	7	5	7	1	15
37	10	5	2	3	9	5	2	13
49	—	7	0	7	1	4	1	18

CLOTH MEASURE.

(21)			(22)		
yd.	*qr.*	*n.*	*EE.*	*qr.*	*n.*
135	3	3	272	2	1
70	2	2	152	1	2
95	3	0	79	0	1
176	1	3	156	2	0
26	0	1	79	3	1
279	2	1	154	2	1

LONG MEASURE.

(23)

yd.	*feet.*	*in.*	*bar.*
225	1	9	1
171	0	3	2
52	2	3	2
397	0	10	1
154	2	7	2
137	1	4	1

(24)

lea.	*m.*	*fur.*	*p.*
72	2	1	19
27	1	7	22
35	2	5	31
79	0	6	12
51	1	6	17
72	0	5	21

LAND MEASURE.

(25)

a.	*r.*	*p.*
726	1	31
219	2	17
1455	3	14
379	1	21
1195	2	14

(26)

a.	*r.*	*p.*
1232	1	14
327	0	19
131	2	15
1219	1	18
459	2	17

WINE MEASURE.

(27)

hhd.	*gal.*	*qts.*
31	57	1
97	18	2
76	13	1
55	46	2
87	38	3
55	17	1

(28)

T.	*hhd.*	*gal.*	*qts.*
14	3	27	2
19	2	56	3
17	0	39	2
75	2	16	1
54	1	19	2
97	3	54	3

ALE AND BEER MEASURE.

(29)

bar.	*fir.*	*gal.*
25	2	7
17	3	5
96	2	6
75	1	4
96	3	7
75	0	5

(30)

hhd.	*gal.*	*qts.*
76	51	2
57	3	3
97	27	3
22	17	2
32	19	3
55	38	3

DRY MEASURE.

(31)

ch.	*bu.*	*pks.*
75	2	1
41	24	1
92	16	1
70	13	2
54	17	3
79	25	1

(32)

lasts.	*weys.*	*qts.*	*bu.*	*pks.*
38	1	4	5	3
47	1	3	6	2
62	0	2	4	3
45	1	4	3	3
78	1	1	2	2
29	1	3	6	2

TIME.

(33)

w.	*d.*	*h.*
71	3	11
51	2	9
76	0	21
95	3	21
79	1	15

(34)

w.	*d.*	*h.*	*m.*	*sec.*
57	2	15	42	41
95	3	21	27	51
76	0	15	37	28
53	2	21	42	27
98	2	18	47	38

SUBTRACTION OF MONEY, WEIGHTS, AND MEASURES.

RULE.—Subtract as in Integers, only when the lower figure is greater than the upper, borrow so many of that denomination as make one of the next superior, adding them to the upper, from which take the lower; set down the difference, and carry one to the next higher denomination. Or,

When you borrow, instead of adding to the top figure, subtract the lower from that number, and add the remainder to the top figure.

PROOF.—As in Integers.

EXAMPLES.—XIV.

MONEY.

(1)

	£	s.	d.
Borrowed	715	2	$7\frac{1}{4}$
Paid	476	3	$8\frac{1}{2}$
Remains to pay	238	18	$10\frac{3}{4}$
Proof	715	2	$7\frac{1}{4}$

(2)

	£	s.	d.
Lent	316	3	$5\frac{1}{2}$
Received	218	2	$1\frac{3}{4}$

(3)

£	s.	d.
87	2	10
79	3	$7\frac{1}{4}$

(4)

£	s.	d.
3	15	$1\frac{1}{2}$
1	14	7

(5)

£	s.	d.
25	2	$5\frac{1}{4}$
17	9	$8\frac{1}{2}$

(6)

£	s.	d.
37	3	$4\frac{1}{4}$
25	5	$2\frac{1}{4}$

(7)

£	s.	d.
321	17	$1\frac{1}{2}$
257	14	7

(8)

£	s.	d.
59	15	$3\frac{1}{4}$
36	17	2

(9)

£	s.	d.
71	2	4
19	13	$7\frac{3}{4}$

(10)

£	s.	d.
527	3	$5\frac{1}{4}$
139	5	$7\frac{1}{2}$

TROY WEIGHT.

	(11) *lb.*	*oz.*	*dwt.*	*gr.*	(12) *lb.*	*oz.*	*dwt.*	*gr.*
Bought	52	1	7	2	7	2	2	7
Sold	39	0	15	7	5	7	1	5
Unsold								

AVOIRDUPOIS WEIGHT.

(13) *lb.*	*oz.*	*dr.*	(14) *cwt.*	*qrs.*	*lb.*	(15) *T.*	*cwt.*	*qrs.*	*lb.*
35	10	5	35	1	21	21	1	2	7
29	12	7	25	1	10	9	1	3	5

APOTHECARIES' WEIGHT.

(16) ℔	℥	ʒ	℈	(17) ℔	℥	ʒ	℈	*gr.*
5	2	1	0	9	7	2	1	13
2	5	2	1	5	7	3	1	18

CLOTH MEASURE.

(18) *yds.*	*qrs.*	*n.*	(19) *EE.*	*qrs.*	*n.*
71	1	2	35	2	1
3	2	1	14	3	2

LONG MEASURE.

(20) *yds.*	*ft.*	*in.*	*bar.*	(21) *leag.*	*mi.*	*fur.*	*po.*
107	2	10	1	147	2	6	29
78	2	11	2	58	2	7	33

LAND MEASURE.

(22)

a.	*r.*	*p.*
175	1	27
59	0	27

(23)

a.	*r.*	*p.*
325	2	1
279	3	5

WINE MEASURE.

(24)

hhd.	*gal.*	*qts.*	*pi.*
47	47	2	1
28	59	3	0

(25)

tun.	*hhd.*	*gal.*	*qts.*
42	2	37	2
17	3	49	3

ALE AND BEER MEASURE.

(26)

bar.	*fir.*	*gal.*
25	1	2
21	1	5

(27)

hhd.	*gal.*	*qts.*
27	27	1
12	50	2

DRY MEASURE.

(28)

qu.	*bu.*	*p.*
72	1	2
35	2	3

(29)

qu.	*bu.*	*p.*
65	2	1
57	2	3

(30)

ch.	*bu.*	*p.*
79	3	0
54	7	1

TIME.

(31)

yrs.	*mo.*	*we.*	*da.*
79	8	2	4
23	9	3	5

(32)

ho.	*min.*	*sec.*
34	42	45
19	53	47

MULTIPLICATION

OF SEVERAL DENOMINATIONS.

RULE.—Multiply the first denomination by the quantity given, dividing the product by as many of that as make one of the next, setting down the remainder, and add the quotient to the next superior, after it is multiplied.

If the given quantity is above 12, multiply by any two numbers which, multiplied together, will make the same number; but if no two numbers multiplied together will make the exact number, then multiply the top line by as many as are wanting, adding it to the last product.

PROOF.—By Division.

£	s.	d.
35	12	$7\frac{1}{4}$
		2
71	5	$2\frac{1}{2}$

£	s.	d.
75	13	$1\frac{1}{2}$
		3

£	s.	d.
62	5	$4\frac{1}{4}$
		4

£	s.	d.
57	2	$4\frac{3}{4}$
		5

EXAMPLES.—XV.

(1)

	s.	d.
18 yds. of cloth at per yard.	9	6
$9 \times 2 = 18$		9
	4	5
		6
		2
	8	11
		0

(2)

	£	s.	d.
26 tons of coal at per ton.	1	2	6
			8
$8 \times 3 + 2 = 26$			
	9	0	0
			3
	27	0	0
Top line $\times\ 2 = 2$	5	0	
	29	5	0

(3) 21 ells of Holland, at 7s. $8\frac{1}{2}$d. per ell.
Ans. £8 1*s.* $10\frac{1}{2}d.$

(4) 35 firkins of butter, at 15s. $3\frac{1}{2}$d. per firkin.
Ans. £26 15*s.* $2\frac{1}{2}d.$

(5) 75 lb. of nutmegs at 7s. $2\frac{3}{4}$d. per lb. *Ans.* £27 2*s.* $2\frac{1}{4}d.$

(6) 97 cwt. of cheese, at £1 5s. 3d. per cwt.
Ans. £122 9*s.* 3*d.*

(7) 127 lb. of tea, at 4s. 3d. per lb. *Ans.* £26 19*s.* 9*d.*

(8) 135 gallons of rum, at 7s. 5d. per gallon.
Ans. £50 1*s.* 3*d.*

(9) 74 ells of diaper, at 1s. $4\frac{1}{2}$d. per ell. *Ans.* £5 1*s.* 9*d.*

(10) 6 dozen pair of gloves, at 1s. 10d. per pair. *Ans.* £6 12*s.*

When the given quantity consists of $\frac{1}{2}$, $\frac{1}{4}$, divide the price by $\frac{1}{2}$, $\frac{1}{4}$; when $\frac{3}{4}$ divide the price by $\frac{1}{2}$, and that quotient by $\frac{1}{2}$, which add to the product of the quantity given.

(11) $25\frac{1}{2}$ ells of Holland, at 3s. $4\frac{1}{2}$d. per ell.

	3	$4\frac{1}{2}$	
		5	$5 \times 5 = 25$
16		$10\frac{1}{2}$	
		5	
4	4	$4\frac{1}{2}$	$= 25$
0	1	$8\frac{1}{4}$	$= \frac{1}{2}$
4	6	$0\frac{3}{4}$	$= 25\frac{1}{2}$

(12) $75\frac{1}{2}$ ells of diaper, at 1s. 3d. per ell.
Ans. £4 14*s.* $4\frac{1}{2}$*d.*

(13) $19\frac{1}{2}$ ells of damask, at 4s. 3d. per ell.
Ans. £4 2*s.* $10\frac{1}{2}$*d.*

(14) $35\frac{1}{2}$ cwt. double refined sugar, at £4 15s. 6d. per cwt.
Ans. £169 10*s.* 3*d.*

(15) $154\frac{1}{2}$ cwt. of tobacco, at £4 17s. 10d. per cwt.
Ans. £755 15*s.* 3*d.*

(16) $117\frac{1}{4}$ gallons of gin, at 12s. 6d. per gallon.
Ans. £73 5*s.* $7\frac{1}{2}$*d.*

(17) $85\frac{3}{4}$ cwt. of cheese, at £1 7s. 8d. per cwt.
Ans. £118 12*s.* 5*d.*

(18) $56\frac{3}{4}$ cwt. of sugar, at £2 18s. 7d. per cwt.
Ans. £166 4*s.* $7\frac{1}{4}$*d.*

(19) $96\frac{1}{2}$ cwt. of currants, at £2 15s. 6d. per cwt.
Ans. £267 15*s.* 9*d.*

(20) $120\frac{1}{4}$ cwt. of hops, at £4 7s. 6d. per cwt.
Ans. £528 5*s.* $7\frac{1}{2}$*d.*

EXAMPLES OF WEIGHTS AND MEASURES.

(21) Multiply 9 lb. 10 oz. 15 dwt. 19 gr. by 9.
(22) Multiply 23 tons, 19 cwt. 3 qrs. 18 lb. by 7.
(23) Multiply 107 yards, 3 qrs. 2 nails, by 10.
(24) Multiply 33 bar. 2 firk. 3 gal. by 11.
(25) Multiply 110 miles, 6 fur. 26 poles, by 12.

DIVISION

OF SEVERAL DENOMINATIONS.

RULE.—Divide the first Denomination on the left hand; and, if any remains, multiply them by as many of the next less as make one of that; which add to the next, and divide as before.

PROOF.—By Multiplication.

£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
2)25	2	4	3)37	7	7	4)57	5	7	5)52	7	0
12	11	2									

EXAMPLES.—XVI.

(1) Divide £1407 17s. 7d. by 243.
(2) Divide £700791 14s. 4d. by 1794.
(3) Divide £490981 3s. 7½d. by 31715.
(4) Divide £19743052 5s. 7½d. by 214723.

EXAMPLES OF WEIGHTS AND MEASURES.

(5) Divide 83 lb. 5 oz. 10 dwt. 17 gr. by 8.
(6) Divide 29 tons, 17 cwt. 0 qrs. 18 lb. by 9.
(7) Divide 114 yards, 3 qrs. 2 nails, by 10.
(8) Divide 1017 miles, 6 fur. 38 poles, by 11.
(9) Divide 2019 acres, 3 roods, 29 poles, by 26.
(10) Divide 117 years, 7 months, 3 weeks, 5 days, 11 hours, 27 minutes, by 37.

BILLS OF PARCELS.

HOSIER'S.

Mr. John Thomas March 7, 1866.

Bought of Samuel Green,

		s.	d.	
8 Pair of worsted stockings	at	4	6	per pair £
5 Pair of thread ditto	at	3	2	.....
3 Pair of black silk ditto...	at	14	0	.....
4 Pair spun hose.....	at	7	6	.....
6 Pair of cotton ditto	at	4	2	.....
2 Yards of fine flannel.....	at	1	8	per yard.

£7 12 2

MERCER'S.

Mr. Isaac Grant March 7, 1866.

Bought of John Sims,

		s.	d.	
15 Yards of satin	at	9	6	per yard £
52 Yards of black silk	at	6	0	.....
12 Yards of rich brocade...	at	19	8	.....
16 Yards of sarsenet.....	at	3	2	.....
13 Yards of Genoa velvet...	at	27	6	.....
23 Yards of glacé	at	6	3	.....

£62 2 5

LINEN DRAPER'S.

Mr. Simon Surety 27th March, 1866.

Bought of Josiah Short,

		s.	d.	
8 Yards of cambric	at	6	3	per yard £
49½ Yards of muslin	at	2	0	.....
15 Linen sheetings	at	5	4	each .....
2 Dozen table napkins...	at	2	3	each .....
7 Stout cotton sheetings	at	3	2	each .....
35 Huckaback towellings	at	1	1½	each .....

£17 4 6½

MILLINER'S.

Mrs. Bright April 25, 1866.

Bought of Lucy Brown,

	£	s.	d.	
18 Yards of fine lace ... at	0	12	3	per yard £
5 Pair of kid gloves ... at	0	2	2	per pair
4 Fine lace falls..... at	0	10	6	each.....
2 Velvet bonnets ..... at	3	8	0	each.....
4 dozen Irish lamb..... at	0	1	3	per pair.
2 Feathers ..... at	0	7	6	each .....

£23 14 4

STATIONER'S.

Mr. Giles Harris April 12, 1866.

Bought of Abel Smith,

	s.	d.	
27 Reams of blue-wove note at	3	9	per ream £
75 Reams of straw ditto ... at	1	7	per ream
36 Gross magnum bonum pens ..... at	1	8	per gross
15 Reams of foolscap ..... at	11	6	per ream
17 Reams of ditto ..... at	10	7	per ream
120 Blotting pads..... at	1	2½	each ...

£38 17 5

GROCER'S.

Mr. Richard Groves April 21, 1866.

Bought of Francis Elliott,

	s.	d.	
25 lb. of lump sugar ..... at	0	6½	per lb. £
30 Bottles of pickles..... at	0	11½	per bottle
14 lb. of rice ..... at	0	3	per lb. ...
28 lb. of Valencia raisins... at	0	5	,,
15 lb. of currants ..... at	0	5½	,,
7 Boxes of figs..... at	1	10	per box

£3 2 9½

CHEESEMONGER'S.

Mr. Charles Cross April 23, 1866.

Bought of Samuel Grant,

		s.	*d.*	
8 lb. fresh Devonshire butter	at	1	10	per lb.
17 lb. Dorset butter	at	1	2	per lb.
15 lb. bacon	at	0	11	per lb.
5 dozen fresh eggs	at	0	10	per doz.
25 lb. Cheshire cheese	at	0	11	per lb.

£3 15 4

REDUCTION

Is the bringing or reducing numbers of one Denomination into other numbers of another Denomination, retaining the same value, and is performed by Multiplication and Division.

Rule.—*First.* All higher Denominations are brought into lower Denominations by multiplying with so many of the less as make one of the greater. This is Reduction Descending.

Secondly. All lower Denominations are brought into higher Denominations by dividing with so many of the less as make one of the greater. This is Reduction Ascending.

Note.—When the question contains a compound number, and there are various denominations intervening between those given and required, multiply or divide by such figures as may be found requisite, according to its respective table, that will produce the different gradations, taking in the odd figures, if you multiply, that correspond in name to each, till you obtain the answer. When division is used, the remainder is always of the same name as the dividend.

Proof.—Reverse the work, that is, commence with the answer, and divide where you multiplied, and multiply where you divided; or, if the question be not a compound number, divide or multiply the answer by such figure as will at once produce the given term.

Reduction Descending.

EXAMPLES.—XVII.

(1) In £12, how many shillings and pence?

Ans. 240*s.* 2880*d.*

(2) How many crowns and shillings in £25?
Ans. 100 *crowns*, 500 *shillings*

(3) In 57 half-crowns, how many pence and farthings?
Ans. 1710*d.* 6840 *far.*

(4) Reduce £7 5s. into shillings and pence.
Ans. 145*s.* 1740*d.*

(5) In £25 14s. 1d. how many shillings and pence?
Ans. 514*s.* 6169*d.*

(6) In £18, how many shillings, pence, and farthings?
Ans. 360*s.* 4320*d.* 17280 *far.*

(7) How many farthings are there in 21 guineas?
Ans. 21168

(8) In £17 5s. 3¼d. how many farthings? *Ans.* 16573

Reduction Ascending.

(9) In 1740 pence, how many shillings and pounds?
Ans. 145*s.* £7 5*s.*

(10) In 6169 pence, how many shillings and pounds?
Ans. 514*s.* £25 14*s.* 1*d.*

(11) How many crowns and pounds in 500 shillings?
Ans. 100 *crowns*, £25

(12) In 6840 farthings, how many pence and half-crowns?
Ans. 1710*d.* 57 *half-crowns*

(13) How many pence, shillings, and pounds are there in 17280 farthings? *Ans.* 4320*d.* 360*s.* £18

(14) How many sixpences, half-crowns, and pounds in 6000 threepences?
Ans. 3000 *sixpences*, 600 *half-crowns*, £75

Ascending and Descending.

(15) In 130 shillings, how many crowns and pence?
Ans. 26 *crowns*, 1560 *pence*

(16) How many shillings, crowns, and pounds in 60 guineas? *Ans.* 1260*s.* 252 *crowns*, £63

(17) In £63, how many crowns, shillings, and guineas?
Ans. 252 *crowns*, 1260 *shillings*, 60 *guineas*

(18) If 103 guineas and 7 shillings are to be divided equally among 7 men, what is each to receive?
Ans. £15 10*s.*

(19) Seven men brought £15 10s. each to the Bank, to be changed for guineas: how many must they receive?

Ans. 103 *guineas* and 7*s.*

TROY WEIGHT.

(20) In 27 ounces of gold, how many grains?

Ans. 12960

(21) In 3 lb. 10 oz. 7 dwt. 5 gr. how many grains?

Ans. 22253

(22) In 7 ingots of silver, each weighing 23lb. 5oz. 7dwt., how many grains? *Ans.* 945336

(23) How many ingots, each 7 lb. 4 oz. 17 dwt. 15 gr., are in 341304 grains? *Ans.* 8

(24) In 8 ingots of silver, each weighing 7 lb. 4 oz. 17 dwt. 15 gr., how many ounces, pennyweights, and grains?

Ans. 711 *oz.*, 14221 *dwt.*, 341304 *gr.*

AVOIRDUPOIS WEIGHT.

(25) In 9 cwt. 2 qr. 14 lb. of indigo, how many pounds?

Ans. 1078

(26) In 34 tons 17 cwt. 1 qr. 19 lb. how many pounds?

Ans. 78111

(27) In 14769 ounces, how many cwt.?

Ans. 8 *cwt.* 27 *lb.* 1 *oz.*

(28) Reduce 8 cwt. 27 lb. 1 oz. into quarters, pounds, and ounces. *Ans.* 32 *qr.* 923 *lb.* 14769 *oz.*

(29) How many pounds in 27 hogsheads of tobacco, each weighing $8\frac{3}{4}$ cwt.? *Ans.* 26460

(30) In 27 cwt. of raisins, how many parcels, each 18 lb.?

Ans. 168

(31) In 32 bags of hops, each 2 cwt. 1 qr. 14 lb., and another of 150 lb., how many cwt. in the whole?

Ans. 77 *cwt.* 1 *qr.* 10 *lb.*

(32) In 27 bags of hops, each 2 cwt. 1 qr. 15 lb., and 1 bag of 137 lb., how many cwt. together?

Ans. 65 *cwt.* 2 *qr.* 10 *lb.*

APOTHECARIES' WEIGHT.

(33) Reduce 27 lb. 7 oz. 2 dr. 1 sc. 2 gr. into grains.

Ans. 159022

(34) In 159022 grains, how many lb.?
Ans. 27 *lb.* 7 *oz.* 2 *dr.* 1 *sc.* 2 *gr.*

CLOTH MEASURE.

(35) In 27 yards, how many nails? *Ans.* 432
(36) In 24 pieces, each containing 32 Flemish ells, how many ells English? *Ans.* 460 *ells*, 4 *qr.*
(37) Bought 27 pieces of English stuffs, each 27 ells; how many yards? *Ans.* 911 *yards*, 1 *qr.*
(38) In 12 bales of cloth, each 25 pieces, each 15 English ells, how many yards? *Ans.* 5625

LONG MEASURE.

(39) Reduce 57 miles into poles. *Ans.* 18240
(40) In 18240 poles, how many miles? *Ans.* 57
(41) In 72 leagues, how many yards? *Ans.* 380160
(42) In 380160 yards, how many leagues? *Ans.* 72
(43) In 50 leagues, how many miles, yards, feet, inches, and barleycorns?
Ans. 150 *miles*, 264000 *yards*, 792000 *feet*, 9504000 *inches*, 28512000 *barleycorns*
(44) How many barleycorns will reach round the world, which is 360 degrees, each containing 69½ miles?
Ans. 4755801600
(45) How many times will a wheel, that is 2¾ yards in circumference, turn between London and York, which is 198 miles? *Ans.* 126720

LAND MEASURE.

(46) In 27 acres, how many roods and perches?
Ans. 108 *roods*, 4320 *perches.*
(47) In 4320 perches, how many acres? *Ans.* 27
(48) A person having a piece of ground that contains 37 acres 1 pole, has a mind to dispose of 15 acres; how many perches will he have left? *Ans.* 3521

WINE MEASURE.

(49) Bought 5 tuns of port wine; how many gallons and pints? *Ans.* 1260 *gallons*, 10080 *pints*
(50) In 10080 pints, how many tuns? *Ans.* 5

ALE AND BEER MEASURE.

(51) In 46 barrels of beer, how many pints? *Ans.* 13248

(52) In 72 hogsheads of beer, how many barrels?

Ans. 108

(53) In 108 barrels of beer, how many hogsheads?

Ans. 72

DRY MEASURE.

(54) In 120 quarters of wheat, how many bushels, pecks, gallons, and quarts?

Ans. 960 *bush.* 3840 *pecks*, 7680 *gall.* 30720 *qts.*

(55) In 30720 quarts of corn, how many quarters?

Ans. 120

(56) In 273 lasts of corn, how many pecks? *Ans.* 87360

TIME.

(57) In 72015 hours, how many weeks?

Ans. 428 *weeks*, 4 *days*, 15 *hours*

(58) From November 17 to September 12 following, how many days? *Ans.* 299

(59) From July 18 to December 27 following, how many seconds? *Ans.* 13996800

VULGAR FRACTIONS.

A Fraction expresses a part or parts of an integer or unit. A Vulgar (or common) Fraction is represented by placing two figures or numbers, one above the other, with a line between them, as $\frac{1}{4}$, $\frac{3}{8}$, &c. The upper figure or number is called the *numerator*, and the lower one the *denominator*.

The *denominator* determines how many parts the unit is divided into, and the *numerator* shows how many of those parts the fraction represents.

There are four sorts of VULGAR FRACTIONS, viz., *proper*, *improper*, *compound*, and *mixed*.

1. A PROPER FRACTION is when the numerator is less than the denominator, as $\frac{2}{4}$, $\frac{3}{6}$, $\frac{9}{11}$, &c.

2. An IMPROPER FRACTION is when the numerator is equal to, or greater than, the denominator, as $\frac{5}{3}$, $\frac{12}{12}$, $\frac{107}{2}$, &c.

3. A Compound Fraction is the fraction of a fraction, as $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{7}{9}$, &c.

4. A Mixed Number or Fraction is composed of a whole number and a fraction, as $17\frac{1}{2}$, &c.

A Single or Simple Fraction consists but of one numerator and denominator, as $\frac{4}{7}$.

REDUCTION OF VULGAR FRACTIONS.

To find the greatest common measure of the numerator and denominator of a Fraction.

Rule.—Divide the lower term by the upper, and that divisor by the remainder; proceed in like manner till there is no remainder: the last divisor is the greatest common measure.

EXAMPLES.—XVIII.

Find the greatest common measure of $\frac{72}{136}$. *Ans.* 8

72)136(1
72

64)72(1
64

·8)64(8
64

(1) What is the G.C.M. of $\frac{156}{1524}$? *Ans.* 12

(2) What is the G.C.M. of $\frac{171}{1440}$? *Ans.* 9

(3) What is the G.C.M. of $\frac{203}{2310}$? *Ans.* 7

To reduce Fractions to their lowest terms.

Rule.—Find the greatest common measure for the given fraction, then divide both the numerator and denominator by the greatest common measure, and the quotients will be the fraction required.

If the greatest common measure happen to be one, the fraction is already in its lowest terms; when ciphers are on the right of both numbers, they may be cut off before finding the common measure.

EXAMPLES.—XIX.

(1) Reduce $\frac{24}{32}$ to its lowest terms.
Common measure 8, then $8)\frac{24}{32}(\frac{3}{4}$ *Answer.*

(2) Reduce $\frac{30}{125}$ to its lowest terms. *Ans.* $\frac{6}{25}$

(3) Reduce $\frac{208}{684}$ to its lowest terms. *Ans.* $\frac{52}{171}$

(4) Reduce $\frac{192}{576}$ to its lowest terms. *Ans.* $\frac{1}{3}$

(5) Reduce $\frac{825}{960}$ to its lowest terms. *Ans.* $\frac{55}{64}$

(6) Reduce $\frac{5184}{6912}$ to its lowest terms. *Ans.* $\frac{3}{4}$

To find the least common multiple of two or more numbers.

RULE.—Set the numbers in a line, and strike out any that are exactly contained in either of the others. Then divide by any number that is exactly contained in one or more of the remaining numbers. Set down the quotient under those in which it is exactly contained; also set down, under any that exactly contain a measure thereof, the quotient obtained by dividing by that measure; and under those that have no common measure at all with the divisor, repeat the numbers themselves. Use this new line as you have used the original, and so on, until the numbers left in line have no common measure. Then multiply together all the divisors and the remaining numbers; the product will be the least common multiple.

EXAMPLES.—XX.

(1) Find the least common multiple of 3, 6, 7, 12, 14.
Ans. 84

(2) Find the L.C.M. of 36, 49, 28, 54. *Ans.* 5292

To reduce Fractions to a common denominator.

RULE.—The least common multiple of the denominators will be the common denominator. Divide this common denominator by each denominator in turn, and the quotients, multiplied each one by its corresponding numerator, will be the new numerators.

EXAMPLES.—XXI.

(1) Reduce $\frac{2}{4}$ and $\frac{4}{7}$ to a common denominator.

$4 \times 7 = 28$
$2 \times 7 = 14$ *Ans.* $\frac{14}{28}$, *and* $\frac{16}{28}$
$4 \times 4 = 16$

(2) Reduce $\frac{7}{8}$, $\frac{4}{6}$, $\frac{6}{10}$, and $\frac{6}{7}$, to a common denominator.

Ans. $\frac{735}{840}$, $\frac{560}{840}$, $\frac{504}{840}$, $\frac{720}{840}$

(3) Reduce $\frac{6}{10}$, $\frac{2}{4}$, $\frac{1}{7}$, $\frac{3}{6}$, to a common denominator.

Ans. $\frac{252}{420}$, $\frac{210}{420}$, $\frac{60}{420}$, $\frac{210}{420}$

(4) Reduce $\frac{4}{5}$, $\frac{2}{3}$, $\frac{3}{7}$, and $\frac{1}{8}$, to a common denominator.

Ans. $\frac{672}{840}$, $\frac{560}{840}$, $\frac{360}{840}$, $\frac{105}{840}$

To reduce a mixed number to an Improper Fraction.

RULE.—Multiply the whole number by the denominator of the fraction, and to the product add the numerator for a new numerator, which place over the denominator.

To express a whole number as a fraction, put 1 for the denominator.

EXAMPLES.—XXII.

(1) Reduce $18\frac{3}{7}$ to an improper fraction. *Ans.* $\frac{129}{7}$

$18 \times 7 + 3 = 129$ *new numerator* $= \frac{129}{7}$

(2) Reduce $56\frac{1}{2}\frac{3}{2}$ to an improper fraction. *Ans.* $\frac{1245}{22}$

(3) Reduce $183\frac{5}{21}$ to an improper fraction. *Ans.* $\frac{3848}{21}$

(4) Reduce $13\frac{4}{5}$ to an improper fraction. *Ans.* $\frac{69}{5}$

(5) Reduce $27\frac{2}{9}$ to an improper fraction. *Ans.* $\frac{245}{9}$

To reduce an Improper Fraction to its proper terms.

RULE.—Divide the upper term by the lower.

EXAMPLES.—XXIII.

(1) Reduce $\frac{129}{7}$ to its proper terms. *Ans.* $18\frac{3}{7}$

$129 \div 7 = 18\frac{3}{7}$

(2) Reduce $\frac{1245}{22}$ to its proper terms. *Ans.* $56\frac{13}{22}$

(3) Reduce $\frac{3848}{21}$ to its proper terms. *Ans.* $183\frac{5}{21}$

(4) Reduce $\frac{245}{9}$ to its proper terms. *Ans.* $27\frac{2}{9}$

To reduce a Compound Fraction to a Single one.

RULE.—Multiply all the numerators for a new numerator, and all the denominators for a new denominator.

Reduce the new fraction to its lowest terms.

EXAMPLES.—XXIV.

(1) Reduce $\frac{2}{3}$ of $\frac{3}{5}$ of $\frac{5}{8}$ to a single fraction.

$2 \times 3 \times 5 = 30$

$3 \times 5 \times 8 = 120$

$\frac{30}{120} = \frac{1}{4}$. *Ans.*

(2) Reduce $\frac{5}{9}$ of $\frac{4}{7}$ of $\frac{11}{12}$ to a single fraction.

Ans. $\frac{220}{756} = \frac{55}{189}$

(3) Reduce $\frac{3}{4}$ of $\frac{5}{6}$ of $\frac{9}{10}$ to a single fraction.

Ans. $\frac{135}{240} = \frac{9}{16}$

(4) Reduce $\frac{4}{5}$ of $\frac{6}{8}$ of $\frac{7}{9}$ to a single fraction.

Ans. $\frac{168}{360} = \frac{7}{15}$

(5) Reduce $\frac{2}{7}$ of $\frac{5}{9}$ of $\frac{8}{10}$ to a single fraction.

Ans. $\frac{80}{630} = \frac{8}{63}$

To reduce Fractions of one denomination to the Fraction of another, but greater, *retaining the same value.*

RULE.—Make the given fraction a compound one, by inserting all the denominations between it and that denomination to which you would bring it; then reduce the compound fraction to a single one.

EXAMPLES.—XXV.

(1) Reduce $\frac{7}{8}$ of a penny to the fraction of a pound.

Ans. $\frac{7}{8}$ of $\frac{1}{12}$ of $\frac{1}{20} = \frac{7}{1920}$

(2) Reduce $\frac{1}{4}$ of a penny to the fraction of a pound.

Ans. $\frac{1}{960}$

(3) Reduce $\frac{4}{5}$ of a dwt. to the fraction of a lb. troy.

Ans. $\frac{1}{300}$

(4) Reduce $\frac{4}{7}$ of a lb. avoirdupois to the fraction of a cwt.

Ans. $\frac{1}{196}$

To reduce Fractions of one denomination to the Fraction of another, but less, *retaining the same value.*

RULE.—Multiply the numerator by the parts contained in the several denominations between it and that to which you would reduce it, for a new numerator, and place it over the given denominator.

Reduce the new fraction to its lowest terms.

EXAMPLES.—XXVI.

(1) Reduce $\frac{7}{1920}$ of a pound to the fraction of a penny.

Ans. $\frac{7}{8}$

$7 \times 20 \times 12 = 1680$. $\frac{1680}{1920}$ reduced to its lowest term $= \frac{7}{8}$.

(2) Reduce $\frac{1}{960}$ of a pound to the fraction of a penny.

Ans. $\frac{1}{4}$

(3) Reduce $\frac{4}{1200}$ of a lb. troy to the fraction of a penny-weight. *Ans.* $\frac{4}{5}$

(4) Reduce $\frac{4}{784}$ of a cwt. to the fraction of a lb. *Ans.* $\frac{4}{7}$

To find the proper quantity of a Fraction in the known parts of an integer.

RULE.—Multiply the numerator by the parts that compose the integer, and divide by the denominator; reduce the remainder to the next lower denomination and divide again; proceed in like manner to the lowest term, and the various quotients will form the answer.

EXAMPLES.—XXVII.

(1) Reduce $\frac{3}{4}$ of a pound sterling to its proper quantity.
$3 \times 20 = 60 \div 4 = 15s.$ *Ans.* 15*s.*

(2) Reduce $\frac{7}{9}$ of a cwt. to its proper quantity.
Ans. 3 *qrs.* 3 *lb.* 1 *oz.* $12\frac{4}{9}$ *dr.*

(3) Reduce $\frac{3}{5}$ of a lb. troy to its proper quantity.
Ans. 7 *oz.* 4 *dwt.*

(4) Reduce $\frac{5}{9}$ of an ell English to its proper quantity.
Ans. 2 *qr.* $3\frac{1}{9}$ *nails*

(5) Reduce $\frac{4}{5}$ of a mile to its proper quantity.
Ans. 6 *furl.* 16 *poles*

(6) Reduce $\frac{5}{8}$ of an acre to its proper quantity.
Ans. 2 *roods*, 20 *poles*

(7) Reduce $\frac{3}{5}$ of a month to its proper time.
Ans. 2 *weeks*, 2 *days*, 19 *hours*, 12 *minutes*

To reduce any given quantity to the Fraction of a greater denomination, retaining the same value.

RULE.—Reduce the given quantity to the lowest denomination mentioned for a numerator, under which set the integral part reduced to the same denomination for a denominator, and it will be the fraction required, which bring to its lowest terms.

EXAMPLES.—XXVIII.

(1) Reduce 15s. to the fraction of a pound sterling.
Ans. $\frac{15}{20} = \frac{3}{4}$ £

(2) Reduce $4\frac{3}{4}$d. $\frac{1}{5}$f. to the fraction of a shilling. *Ans.* $\frac{2}{5}$

(3) Reduce $\frac{7}{8}$ of a shilling to the fraction of 8s. 9d.
Ans. $\frac{1}{10}$

(4) Reduce 3 qrs. 3 lb. 1 oz. $12\frac{4}{9}$ dr. to the fraction of a cwt. *Ans.* $\frac{7}{9}$

(5) Reduce 7 oz. 4 dwt. to the fraction of a lb. troy.
Ans. $\frac{3}{5}$

(6) Reduce 6 furlongs 16 poles to the fraction of a mile.
Ans. $\frac{4}{5}$

(7) Reduce 2 roods 20 poles to the fraction of an acre.
Ans. $\frac{5}{8}$

(8) Reduce 2 weeks, 2 days, 19 hours, 12 minutes, to the fraction of a month. *Ans.* $\frac{3}{5}$

ADDITION OF VULGAR FRACTIONS.

Rule.—Prepare the fractions, that each be single; then reduce them to a common denominator, and add the new numerators together, under which place the new denominator. If the answer be an improper fraction, reduce it to a whole or mixed number.

When all the denominators are alike, add the numerators only together, and place the total over the denominator.

EXAMPLES.—XXIX.

(1) Add $\frac{2}{3}$ and $\frac{5}{7}$ together. *Ans.* $\frac{14}{21} + \frac{15}{21} = \frac{29}{21} = 1\frac{8}{21}$

(2) Add $\frac{3}{4}$, $\frac{2}{7}$, and $\frac{5}{6}$ together. *Ans.* $1\frac{73}{84}$

(3) Add $\frac{1}{5}$, $4\frac{1}{3}$, and $\frac{2}{5}$ together. *Ans.* $4\frac{14}{15}$

(4) Add $7\frac{2}{3}$ and $\frac{2}{5}$ together. *Ans.* $8\frac{1}{15}$

(5) Add $\frac{2}{7}$ and $\frac{2}{3}$ of $\frac{3}{4}$ together. *Ans.* $\frac{11}{14}$

(6) Add $5\frac{2}{3}$, $6\frac{7}{8}$, and $4\frac{1}{2}$ together. *Ans.* $17\frac{1}{24}$

When the fractions are of several denominations, reduce them to their proper quantities, and add as before.

(7) Add $\frac{3}{4}$ of a pound to $\frac{5}{6}$ of a shilling. *Ans.* 15*s.* 10*d.*

(8) Add $\frac{1}{2}$ of a penny to $\frac{2}{3}$ of a pound. *Ans.* 13*s.* $4\frac{1}{2}$*d.*

(9) Add $\frac{3}{4}$ of a lb. troy to $\frac{1}{6}$ of an ounce.
Ans. 9 *oz.* 3 *dwt.* 8 *gr.*

(10) Add $\frac{4}{5}$ of a ton to $\frac{5}{6}$ of a lb.
Ans. 16 *cwt.* 0 *qr.* 0 *lb.* 13 *oz.* $5\frac{1}{3}$ *dr.*

SUBTRACTION OF VULGAR FRACTIONS.

RULE.—Reduce mixed numbers to improper fractions; compound fractions to simple ones; and fractions of different denominators to a common denominator. The difference of the numerators, written above the common denominator, will be the difference of the fractions required.

EXAMPLES.—XXX.

(1) From $\frac{3}{4}$ take $\frac{5}{7}$.

$3 \times 7 = 21 \quad 5 \times 4 = 20 \quad 21 - 20 = 1$ *num.*

$4 \times 7 = 28$ *den.* *Ans.* $\frac{1}{28}$

(2) From $\frac{5}{6}$ take $\frac{3}{5}$ of $\frac{5}{8}$. *Ans.* $\frac{11}{24}$

(3) From $5\frac{2}{3}$ take $\frac{9}{10}$. *Ans.* $4\frac{23}{30}$

(4) From $3\frac{8}{47}$ take $\frac{3}{5}$. *Ans.* $2\frac{49}{235}$

(5) From $\frac{19}{20}$ take $\frac{1}{7}$ of $\frac{2}{3}$. *Ans.* $\frac{359}{420}$

When the fractions are of several denominations, reduce them to their proper quantities, and subtract as before.

(6) From $\frac{3}{4}$ of a pound take $\frac{3}{4}$ of a shilling. *Ans.* 14*s.* 3*d.*

(7) From $\frac{3}{4}$ of a lb. troy take $\frac{1}{6}$ of an ounce.

Ans. 8 *oz.* 16 *dwt.* 16 *gr.*

(8) From $\frac{4}{5}$ of a ton take $\frac{5}{6}$ of a lb.

Ans. 15 *cwt.* 3 *qr.* 27 *lb.* 2 *oz.* $10\frac{2}{3}$ *dr.*

MULTIPLICATION OF VULGAR FRACTIONS.

RULE.—Prepare the given fractions, if they require it, by reduction; then multiply the numerators together for a new numerator, and the denominators together for a new denominator.

Bring the answer to a mixed fraction, or to its lowest terms, as may be found requisite.

NOTE.—Before multiplying, when any numerator and any denominator have a common measure, cancel the pair, and substitute for each of them respectively the quotient obtained by dividing by the common measure.

EXAMPLES.—XXXI.

(1) Multiply $\frac{3}{4}$ by $\frac{3}{5}$.

Ans. $3 \times 3 = 9$ *num.* $4 \times 5 = 20$ *den.* $\frac{9}{20}$

(2) Multiply $\frac{7}{9}$ by $\frac{2}{3}$. *Ans.* $\frac{14}{27}$
(3) Multiply $48\frac{3}{5}$ by $13\frac{5}{6}$. *Ans.* $672\frac{3}{10}$
(4) Multiply $\frac{16}{21}$ by $\frac{3}{4}$ of $\frac{5}{7}$ of $\frac{4}{5}$. *Ans.* $\frac{960}{2940} = \frac{16}{49}$
(5) Multiply $\frac{9}{10}$ by $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{5}{6}$. *Ans.* $\frac{3}{8}$
(6) Multiply $\frac{3}{4}$ of $\frac{2}{3}$ by $\frac{2}{3}$ of $\frac{1}{3}$. *Ans.* $\frac{1}{9}$
(7) Multiply $5\frac{6}{7}$ by $\frac{5}{6}$. *Ans.* $4\frac{37}{42}$

DIVISION OF VULGAR FRACTIONS.

Rule.—Prepare the fractions, if they require it, that each be single; invert the divisor or divisors, and proceed as in multiplication.

EXAMPLES.—XXXII.

(1) Divide $\frac{9}{20}$ by $\frac{3}{5}$.
Ans. $5 \times 9 = 45$ *num.* $3 \times 20 = 60$ *den.* $\frac{45}{60} = \frac{3}{4}$
(2) Divide $\frac{14}{27}$ by $\frac{2}{3}$. *Ans.* $\frac{7}{9}$
(3) Divide $672\frac{9}{30}$ by $13\frac{5}{6}$. *Ans.* $48\frac{3}{5}$
(4) Divide $\frac{3}{8}$ by $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{5}{6}$. *Ans.* $\frac{9}{10}$
(5) Divide $9\frac{2}{12}$ by $\frac{1}{2}$ of 7. *Ans.* $2\frac{13}{21}$
(6) Divide $\frac{9}{16}$ by $4\frac{1}{2}$. *Ans.* $\frac{1}{8}$
(7) Divide $3\frac{1}{6}$ by $9\frac{1}{2}$. *Ans.* $\frac{1}{3}$

DECIMAL FRACTIONS.

A *Decimal Fraction* differs from a vulgar fraction thus:—Its denominator is always 10, or some power of 10, as 100, 1000, &c., which is not written under the numerator, as in vulgar fractions, but is expressed by marking off with a dot, from the right of the numerator, as many figures as there are ciphers in the denominator—prefixing ciphers if there are not otherwise sufficient figures in the numerator.

Whole Numbers, of course, require no dot, or if placed, it must be on the right of the figures, as 56·.

Mixed Numbers are whole numbers and decimals together, as 21·5 means $21\frac{5}{10}$.

Ciphers on the right of decimals make no alteration in their value, as ·5 is ·50—either of them being but one-half of an integer.

Ciphers on the left of decimals decrease their value, as ·05

or ·005; which is exemplified by placing a denominator instead of a dot, as $\frac{5}{100}$, or $\frac{5}{1000}$.

From which it plainly appears that as whole numbers increase in a tenfold proportion to the left hand, decimal parts decrease in a tenfold proportion to the right hand.

A *Finite Decimal* is that which ends at a certain number of places; but an *Infinite* is that which never ends.

A *Recurring* or *Circulating Decimal* is that wherein one or more figures are constantly repeated, as 2·75222, &c. This is usually expressed by placing a dot over the recurring figure, where only one recurs; where there are more than one, over the first and last figures that recur; and the recurring part is called the repetend.

ADDITION OF DECIMALS.

RULE.—In setting down the numbers to be added, place the figures underneath those of the same value, to perform which the dots must stand in a direct line under each other; then add them as in whole numbers.

EXAMPLES.—XXXIII.

(1) Add 72·5 + 32·071 + 2·1574 + 371·4 + 2·75 together.

	72·5
	32·071
	2·1574
	371·4
	2·75
Answer	480·8784

(2) Add 30·07 + 2·0071 + 59·432 + 7·1.
(3) Add 3·5 + 47·25 + 927·01 + 2·0073 + 1·5.
(4) Add 52·75 + 47·21 + 724 + 31·45 + ·3075.
(5) Add 3275 + 27514 + 1·005 + 725 + 7·32.

SUBTRACTION OF DECIMALS.

RULE.—Place the numbers under each other, as in Addition, and subtract as in whole numbers.

EXAMPLES.—XXXIV.

From ·2754
Take ·2371
Remains ·0383

(1) From 2·37 take 1·76
(2) From 271 take 215·7
(3) From 270·2 take 75·4075
(4) From 571 take 54·72
(5) From 625 take 76·91
(6) From ·107 take ·0007

MULTIPLICATION OF DECIMALS.

RULE.—Place the multiplicand and the multiplier, and multiply them, as in whole numbers; and from the product, reckoning from right to left, point off as many places as there are decimals in the multiplicand and multiplier together; but if there should not be so many figures in the product, supply the deficiency with ciphers, and put the decimal point on the left of them.

EXAMPLES.—XXXV.

(1) Multiply ·2365 by ·2435

·2365
·2435

11825
7095
9460
4730

Answer ·05758775

(2) Multiply 2·071 by 2·27
(3) Multiply 27·15 by 25·3
(4) Multiply 72347 by 23·15
(5) Multiply 17105 by ·3257
(6) Multiply 17105 by ·0237
(7) Multiply 27·35 by 7·70071
(8) Multiply 57·21 by ·0075
(9) Multiply ·007 by ·007
(10) Multiply 20·15 by ·2705
(11) Multiply ·907 by ·0025

When any number of decimals is to be multiplied by 10, 100, 1000, &c., it is only removing the separating point in

the multiplicand so many places towards the right hand as there are ciphers in the multiplier, thus:—

$\cdot 578 \times 10 = 5\cdot 78$. $\cdot 578 \times 100 = 57\cdot 8$. $\cdot 578 \times 1000 = 578$.
$\cdot 578 \times 10000 = 5780$.

DIVISION OF DECIMALS.

Rule.—Divide as in whole numbers, adding ciphers to the dividend as required. Then point off the decimals in the quotient in the following way:—Subtract the number of decimal figures that are in the divisor from the number of decimals in the dividend, and the difference is the number of figures that must be counted from the right to the left, and pointed off.

Note.—1. If the divisor and dividend have both the same number of decimal figures, the quotient will be a whole number.

2. If the dividend has not so many places of decimals as are in the divisor, then so many ciphers must be annexed to the dividend as will make them equal.

3. When the division is done, if the quotient has not so many figures as it should have places of decimals, then so many ciphers must be placed on the left as will make good that deficiency.

EXAMPLES.—XXXVI.

$6\cdot 321)85643\cdot 825000(13549\cdot 094+$

(1) Divide 48 by 144
(2) Divide 217·75 by 65
(3) Divide 125 by ·1045
(4) Divide ·709 by 2·574
(5) Divide 5·714 by 8275
(6) Divide 7382·54 by 6·4252
(7) Divide ·0851648 by 423
(8) Divide 267·15975 by 13·25
(9) Divide 72·1564 by 1347
(10) Divide 715 by 30·75

Note.—When numbers are to be divided by 10, 100, 1000, 10000, &c., it is performed by placing the separating point in the dividend so many places towards the left hand as there are ciphers in the divisor.

Thus, $5784 \div 10 = 578\cdot 4$ | $5784 : 1000 = 5\cdot 784$
$5784 \div 100 = 57\cdot 84$ | $5784 : 10000 = \cdot 5784$

REDUCTION OF DECIMALS.

To reduce a Vulgar Fraction to a Decimal.

Rule.—Add ciphers to the numerator, and divide by the denominator; the quotient is the decimal fraction re-

quired, and is pointed according to the rule for division of decimals.

NOTE.—This quotient will always terminate or recur before the number of its figures is equal to the number indicated by the denominator.

EXAMPLES.—XXXVII.

(1) Reduce $\frac{1}{4}$ to a decimal. *Ans.* ·2

(2) Reduce $\frac{1}{2}$ to a decimal. *Ans.* ·

(3) Reduce $\frac{3}{4}$ to a decimal. *Ans.* ·7

(4) Reduce $\frac{3}{8}$ to a decimal. *Ans.* ·37

(5) Reduce $\frac{11}{14}$ of $\frac{10}{13}$ to a decimal. *Ans.* ·6043956

To reduce a Circulating Decimal to a Vulgar Fraction.

RULE.—Write down the entire decimal to the end of the repetend, subtract from it that part (if any) which does not recur, and the remainder is the numerator. For the denominator, write down as many nines as there are recurring figures, followed by as many ciphers as there are non-recurring figures. Reduce this fraction to its lowest terms.

EXAMPLES.—XXXVIII.

(1) Reduce $\dot{5}$, $1\dot{0}2\dot{9}$, $2\dot{8}\dot{5}$, $\dot{6}$, to vulgar fractions.
Ans. $\frac{5}{9}$, $1\frac{29}{999}$, $2\frac{285}{999}$,

(2) Reduce $\dot{0}\dot{8}\dot{9}$, $1\dot{0}2\dot{9}$, $2\dot{8}\dot{5}$, $\dot{8}0\dot{6}$, to vulgar fractions.
Ans. $\frac{89}{990}$, $1\frac{29}{990}$, $2\frac{17}{18}$, $\frac{12}{15}$

When Money, Weights, or Measures are given,

Reduce them to the lowest denomination mentioned, add ciphers on the right hand for decimals, and divide by so many of the same denomination as make the integer proposed: the quotient will be the answer. Or, place the lowest denomination with ciphers annexed to it, and divide by so many as make one of the next superior; place the whole number given of the same name on the left of this quotient and divide again by so many as make one of the next superior; repeat the same till you arrive at the decimal of the integer proposed.

EXAMPLES.—XXXIX.

(1) Reduce 5s. to the decimal of a £. *Ans.* ·25
(2) Reduce 9s. to the decimal of a £. *Ans.* ·45
(3) Reduce 19s. 5½d. to the decimal of a £. *Ans.* ·97291 +
(4) Reduce 12 grains to the decimal of a lb. troy.
Ans. ·00208 +
(5) Reduce 2 qr. 14 lb. to the decimal of a cwt. *Ans.* ·625
(6) Reduce 2 furlongs to the decimal of a league.
Ans. ·0833 +
(7) Reduce 2 quarts 1 pint to the decimal of a gallon.
Ans. ·625
(8) Reduce 52 days to the decimal of a year. *Ans.* ·142465 +

To find the value of a Decimal Fraction of an Integer.

RULE.—Multiply the decimal given by the number of parts of the next inferior denomination, cutting off an equal number of decimals from the product; then multiply the remainder by the next inferior; proceed in like manner to the lowest denomination.

EXAMPLES.—XL.

(1) What is the value of ·68464 of a £?
Ans. 13*s.* 8¼*d.* ·2544
(2) What is the value of ·002084 of a lb. troy?
Ans. 12 *gr.* ·00384
(3) What is the value of ·625 of a cwt.? *Ans.* 2 *qr.* 14 *lb.*
(4) What is the value of ·625 of a gallon?
Ans. 2 *quarts*, 1 *pint*

Addition and Subtraction of Circulating Decimals

May be performed, with sufficient accuracy for all practical purposes, by repeating the repetend as often as will be seen to insure accuracy for a certain number of decimal places.

EXAMPLES.—XLI.

Find the value, correct to 6 places of decimals, of

(1) $\dot{5}\dot{6}\dot{8}\dot{7} + 1\cdot\dot{2}\dot{3} + 2\cdot\dot{0}\dot{3}\dot{9} + 1\cdot\dot{1}\dot{1}\dot{2}$

(2) $\dot{5}\dot{6}\dot{8}\dot{7} - \cdot\dot{0}\dot{3}\dot{9}$; $3\cdot\dot{1}\dot{2}\dot{5} - 1\cdot\dot{1}\dot{0}\dot{7}$

Multiplication and Division of Circulating Decimals

Are best performed by transforming into vulgar fractions, the resulting fraction being again transformed into a decimal.

NOTE.—This is usually the most convenient process for performing *any* operation with circulating decimals.

Find the value of

(3) $4\cdot\dot{9}8\dot{7} \times \cdot 0\dot{6}\dot{5}$; $2\cdot\dot{1}6 \times 3\cdot\dot{1}6$

(4) $4\cdot\dot{9}8\dot{7} : \cdot 0\dot{6}\dot{5}$; $3\cdot\dot{1}6 \div 2\cdot\dot{1}6$

Decimal Tables of Coins, Weights, and Measures.

TABLE I.

ENGLISH COIN.

£1 the Integer.

s.	*dec.*	*s.*	*dec.*
19	·95	9	·45
18	·9	8	·4
17	·85	7	·35
16	·8	6	·3
15	·75	5	·25
14	·7	4	·2
13	·65	3	·15
12	·6	2	·1
11	·55	1	·05
10	·5		

d.	*Decimals.*
6	·025
5	·020833
4	·016666
3	·0125
2	·008333
1	·004166

Far.	*Decimals.*
3	·003125
2	·0020833
1	·0010416

TABLE II.

ENG. COIN. 1*s.* Int.

Long Meas. 1 Foot the Integer.

Pence and Inches	*Decimals.*
6	·5
5	·416666
4	·333333
3	·25
2	·166666
1	·083333

Far.	*Decimals.*
3	·0625
2	·041666
1	·020833

TABLE III.

TROY WEIGHT.

1lb. the Integer.

Ounces the same as Pence in the last Table.

Penny wght.	*Decimals.*
10	·041666
9	·0375
8	·033333
7	·029166
6	·025
5	·020833
4	·016666
3	·0125
2	·008333
1	·004166

Grns.	*Decimals.*
12	·002083
11	·001910

Grns.	*Decimals.*
10	·001736
9	·001562
8	·001389
7	·001215
6	·001042
5	·000868
4	·000694
3	·000521
2	·000347
1	·000173

1 oz. the Integer.

Pennyweights the same as Shillings in the first Table.

Grns.	*Decimals.*
12	·025
11	·022916
10	·020833
9	·01875
8	·016666
7	·014583
6	·0125
5	·010416
4	·008333
3	·00625
2	·004166
1	·002083

TABLE IV.

AVOIRD. WEIGHT.

112 lb. the Integer.

Qrs.	*Decimals.*
3	·75
2	·5
1	·25

lbs.	*Decimals.*
14	·125
13	·116071
12	·107143
11	·098214
10	·089286
9	·080357
8	·071428
7	·0625
6	·053571
5	·044643
4	·035714
3	·026786
2	·017857
1	·008928

Oz.	*Decimals.*
8	·004464
7	·003906
6	·003348
5	·002790
4	·002232
3	·001674
2	·001116
1	·000558

¼ *Oz.*	*Decimals.*
3	·000418
2	·000279
1	·000139

TABLE V.

AVOIRD. WEIGHT.

1 lb. the Integer.

Oz.	*Decimals.*
8	·5
7	·4375
6	·375
5	·3125
4	·25
3	·1875
2	·125
1	·0625

Drms.	*Decimals.*
8	·03125
7	·027343
6	·023437
5	·019531
4	·015625
3	·011718
2	·007812
1	·003906

TABLE VI.

LIQUID MEASURE.

1 Tun the Integer.

Gals.	*Decimals.*
100	·396825
90	·357141
80	·317460
70	·277777
60	·238095
50	·198412
40	·158730
30	·119047
20	·079365
10	·039682
9	·035714
8	·031746
7	·027777
6	·023809
5	·019841
4	·015873

Gals.	*Decimals.*
3	·011904
2	·007936
1	·003968

Pints.	*Decimals.*
4	·001984
3	·001488
2	·000992
1	·000496

A Hogshead the Integer.

Gals.	*Decimals.*
30	·476190
20	·317460
10	·158730
9	·142857
8	·126984
7	·111111
6	·095238
5	·079365
4	·063492
3	·047619
2	·031746
1	·015873

Pints.	*Decimals.*
3	·005952
2	·003968
1	·001984

TABLE VII.

MEASURES.

Liquid.	Dry.
1 *Gal.*	1 *Qr.*

Integer.

Pts.	*Dec.*	*Bush.*
4	·5	4
3	·375	3
2	·25	2
1	·125	1

Qr. Pt.	*Dec.*	*Peck.*
3	·09375	3
2	·0625	2
1	·03125	1

Decimals.	*Q. Pk.*
·0234375	3
·015625	2
·0078125	1

Decimals.	*Pints.*
·005859	3
·003906	2
·001953	1

TABLE VIII.

LONG MEASURE.

1 Mile the Integer.

Yards.	*Decimals.*
1000	·568182
900	·511364
800	·454545
700	·397727
600	·340909
500	·284091
400	·227272
300	·170454
200	·113636
100	·056818
90	·051136
80	·045454
70	·039773
60	·034091
50	·028409
40	·022727
30	·017045
20	·011364
10	·005682
9	·005114
8	·004545
7	·003977
6	·003409
5	·002841
4	·002273
3	·001704
2	·001136
1	·000568

Feet.	*Decimals.*
2	·0003787
1	·0001894

Inch.	*Decimals.*
6	·0000947
3	·0000474
1	·0000158

TABLE IX.

TIME.

1 Year the Integer. Months the same as Pence in the second Table.

Days.	*Decimals.*
365	1·000000
300	·821918
200	·547945
100	·273973
90	·246575
80	·219178
70	·191781
60	·164383

Days.	*Decimals.*
50	·136986
40	·109589
30	·082192
20	·054794
10	·027397
9	·024657
8	·021918
7	·019178
6	·016438
5	·013698
4	·010959
3	·008219
2	·005479
1	·002732

1 Day the Integer.

Hrs.	*Decimals.*
12	·5
11	·458333
10	·416666
9	·375
8	·333333
7	·291666
6	·25
5	·208333
4	·166666
3	·125
2	·083333
1	·041666

Min.	*Decimals.*
30	·020833
20	·013888
10	·006944
9	·00625
8	·005555
7	·004861
6	·004166
5	·003472
4	·002777
3	·002083
2	·001388
1	·000694

TABLE X.

CLOTH MEASURE.

1 Yard the Integer.
Qrs. the same as Table IV.

Nails.	*Decimals.*
3	·1875
2	·125
1	·0625

TABLE XI.

LEAD WEIGHT.

A Foth. the Integer.

Hun.	*Decimals.*
10	·512820
9	·461538
8	·410256
7	·358974
6	·307692
5	·256410
4	·205128
3	·153846
2	·102564
1	·051282

Qrs.	*Decimals.*
2	·025641
1	·012820

Pnds.	*Decimals.*
14	·0064102
13	·0059523
12	·0054945
11	·0050366
10	·0045787
9	·0041208
8	·0036630
7	·0032051
6	·0027472
5	·0022893
4	·0018315
3	·0013736
2	·0009157
1	·0004578

SIMPLE PROPORTION, OR RULE OF THREE,

Teaches, by three numbers given, to find a fourth in such proportion to the third as the second is to the first.

RULE.—Set down in the third term the number that is of the same kind as the number required; then, of the two remaining numbers, put the greater or the less in the second term, according as the answer must be greater or less than

this third term; and the remaining number will be, of course, in the first term. Bring the first and second terms to the same denomination by reduction, as also the third term to whatever denomination may be convenient. Multiply the second and third terms together, and divide by the first; the quotient will be the answer, in the same denomination as the third term.

PROOF.—As the third term is to the answer, so is the first term to the second.

EXAMPLES.—XLII.

(1) If 2 yards of cloth cost 5s. 6d., what will 50 yards cost?

2 yds. : 50 yds. : : 5s. 6d.

12

66

50

2)3300

12)1650

2,0)137 6

Ans. £6 17*s.* 6*d.*

(2) If a gallon of ale cost 1s. 3d., what cost 32 gallons?

Ans. £2

(3) If 1 lb. of sugar cost $4\frac{1}{2}$d., what cost 54 lb.?

Ans. £1 0*s.* 3*d.*

(4) If a pair of stockings cost 3s. 4d., how many dozen can I buy with £43 5s.? *Ans.* 21 *doz.* $7\frac{1}{2}$ *pair*

(5) If a yard of cloth cost 15s. 6d., what will 48 yards cost at the same rate? *Ans.* £37 4*s.*

(6) If I buy 20 pieces of cloth, each 20 ells, at 12*s.* 6*d.* per ell, what is the value of the whole? *Ans.* £250

(7) What is the half-year's rent of 547 acres of land, at 15s. 6d. per acre per annum? *Ans.* £211 19*s.* 3*d.*

(8) If a pair of shoes cost 6s. $9\frac{1}{2}$d., what will 12 dozen come to? £48 18*s.*

(9) If $1\frac{1}{2}$ oz. of coffee cost $6\frac{1}{4}$d., what will $3\frac{1}{4}$ oz. cost at the same rate? *Ans.* 1*s.* $5\frac{1}{2}$*d.*—1 *rem.*

(10) If 1 oz. of gold be worth £5 4s. 2d., what is the worth of 1 grain? *Ans.* $2\frac{1}{2}$*d.*—20 *rem.*

(11) If 1 English ell 2 qr. cost 4s. 7d., what will $39\frac{1}{2}$ yards cost at the same rate? *Ans.* £5 3*s.* $5\frac{1}{4}$*d.*—5 *rem.*

(12) If 1 lb. of sugar cost $10\frac{1}{2}$d., what is the worth of 1 cwt.? *Ans.* £4 18*s.*

(13) If $3\frac{1}{2}$ lb. of cheese cost 2s. 11d., what cost 1 cwt.? *Ans.* £4 13*s.* 4*d.*

(14) Bought 329 lb. of candles, after the rate of 2s. 8d. for 3 lb.; what did they cost? *Ans.* £14 12*s.* $5\frac{1}{4}$*d.*—1 *rem.*

(15) If my horse stands me in $9\frac{1}{3}$d. per day keeping, what will be the charge of 11 horses for the year? *Ans.* £158 18*s.* $6\frac{1}{2}$*d.*

(16) A gentleman bought a wedge of gold, which weighed 14 lb. 3 ozs. 8 dwt. for £514 4s.; at what rate did he pay per ounce? *Ans.* £3

(17) Gave £1 1s. 8d. for 3 lb. of tea; what must be given for 29 lb. 4 oz.? *Ans.* £10 11*s.* 3*d.*

(18) If 1 oz. of silver be worth 5s., what is the price of 14 ingots, each 7 lb. 5 oz. 10 dwt.? *Ans.* £313 5*s.*

(19) If tea be sold at $5\frac{1}{2}$d. per ounce, what must be given for 2 cwt.? *Ans.* £82 2*s.* 8*d.*

(20) Bought 17 cwt. 1 qr. 14 lb. of iron, at $3\frac{1}{4}$d. per lb.; what does it come to? *Ans.* £26 7*s.* $0\frac{1}{2}$*d.*

(21) A draper bought 420 yards of broad cloth, at the rate of 14s. $10\frac{3}{4}$d. per ell English; how much did he pay for the whole? *Ans.* £250 5*s.*

(22) Bought $27\frac{1}{4}$ yards of muslin, at 6s. $9\frac{1}{2}$d. per yard; what does it come to? *Ans.* £9 5*s.* $0\frac{3}{4}$*d.*—2 *rem.*

(23) If 8 lb. of raisins cost 6s. 6d., what will 18 frails cost, each weighing 3 qr. 18 lb.? *Ans.* £74 11*s.* 9*d.*

(24) If 27 yards of Holland cost £5 12s. 6d., how many ells English can I buy for £100? *Ans.* 384

(25) What will 25 cwt. 3 qr. 14 lb. of tobacco come to at 1s. $3\frac{1}{2}$d. per lb.? *Ans.* £187 3*s.* 3*d.*

(26) Bought 1 cwt. 24 lb. 8 oz. of old lead at 9s. per cwt.; what does it come to? *Ans.* 10*s.* $11\frac{1}{2}$*d.*—112 *rem.*

(27) If a gentleman's income be £500 a year, and he spend 19s. 4d. per day, how much does he lay by at the year's end?
Ans. £147 3*s.* 4*d.*

(28) If 14 yards of broad cloth cost £13 10s., what is the purchase of 75 yards? *Ans.* £72 6*s.* 5*d.*—2 *rem.*

(29) Bought 7 yards of cloth for 17s. 8d.; what must be given for 5 pieces, each 27½ yards?
Ans. £17 7*s.* 0¼*d.*—2 *rem.*

(30) A draper bought 8 packs of cloth, each pack containing 4 parcels, each parcel 10 pieces, and each piece 26 yards, and paid after the rate of £4 16s. for 6 yards; I desire to know what they cost him. *Ans.* £6656

(31) How many yards of cloth may be bought for £21 11s. 1½d., when 3½ yards cost £2 14s. 3d.?
Ans. 27 *yds.* 3 *qr.* 1 *nail*—84 *rem.*

(32) Bought 59 cwt. 2 qr. 24 lb. of tobacco at £2 17s. 4d. per cwt.; what does it come to?
Ans. £171 3*s.* 7¼*d.*—80 *rem.*

(33) A grocer bought 4 hhds. of sugar, each weighing 6 cwt. 2 qr. 14 lb., at £2 8s. 6d. per cwt.; what is the value of the whole? *Ans.* £64 5*s.* 3*d.*

(34) If an ounce of fine gold be sold for £3 10s., what is the value of 7 ingots, each weighing 3 lb. 7 oz. 14 dwt. 21 gr.?
Ans. £1071 14*s.* 5¼*d.*

(35) If 1 cwt. of sugar cost £12 12s. 6d., what must I give for 14 cwt. 1 qr. 19 lb.? *Ans.* £182 0*s.* 11½*d.*—8 *rem.*

(36) If 7 oz. 11 dwt. of gold be worth £35, what is the value of 14 lb. 9 oz. 12 dwt. 16 gr. at the same rate?
Ans. £823 9*s.* 3¾*d.*—552 *rem.*

(37) A gentleman has an annuity of £896 17s. per annum; how much may he spend daily, that at the year's end he may lay up 200 guineas, and give to the poor quarterly £13 10*s.*?
Ans. £1 14*s.* 8*d.*—44 *rem.*

(38) If 8 men do a piece of work in 12 days, what time will 16 men require to perform the same? *Ans.* 6 *days*

(39) If 54 men can build a house in 90 days, how many can do the same in 60 days? *Ans.* 81

(40) If 108 workmen finish a piece of work in 12 days, how many are sufficient to finish it in 3 days? *Ans.* 432

(41) How many yards of cloth, of 3 quarters wide, are equal in measure to 30 yards of 5 quarters wide? *Ans.* 50

(42) A courier makes a journey in 24 days, when he travels 12 hours each day; how long will he be going the same journey when he travels 16 hours daily? *Ans.* 18

(43) If, when a peck of flour is sold for 2s., the penny loaf weighs 8 oz., how much should it weigh when flour is sold at 1s. 6d. per peck? *Ans.* 10 *oz.* $10\frac{2}{3}$ *dr.*

(44) If for 24s. I have 1200 lb. carried 36 miles, how many lb. can I have carried 24 miles for the same money?

Ans. 1800 *lb.*

(45) An army besieging a town, in which were 1000 soldiers, with provisions for 3 months, how many soldiers must depart that the provisions may last 5 months? *Ans.* 400

(46) If £20 worth of wine be sufficient to serve 100 men, when the tun is sold for £30, how many will £20 suffice, when the tun is sold for £24? *Ans.* 125

(47) If I lend my friend £200 for 12 months, how long ought he to lend me £150 to requite my kindness?

Ans. 16 *months*

(48) If 14 pioneers make a trench in 18 days, in what time will 34 do the same? *Ans.* 7 *days*, 4 *hrs.* 56 *min.*—16 *rem.*

THE RULE OF THREE IN VULGAR FRACTIONS.

RULE.—State the question, and reduce, as in whole numbers; bring all the terms into the form of simple fractions; invert the first term; then multiply the three terms continually together, and the product will be the answer.

EXAMPLES.—XLIII.

(1) If $\frac{3}{4}$ of a yard cost $\frac{5}{8}$ of a £, what will $\frac{9}{10}$ of a yard cost?

$$\text{As } \frac{3}{4} : \frac{9}{10} :: \frac{5}{8} : 15s. \text{ } Ans.$$

(2) If $\frac{5}{6}$ of a yard cost $\frac{2}{3}$ £, what will $\frac{11}{12}$ of a yard cost?

Ans. 14*s.* 8*d.*

(3) If $\frac{3}{4}$ of a yard of lawn cost 7s. 3d., what will $10\frac{1}{3}$ yards cost? *Ans.* £4 19*s.* $10\frac{2}{3}$*d.*

(4) If $\frac{7}{8}$ lb. cost $\frac{3}{4}$s., how many pounds will $\frac{8}{9}$ of 1s. buy? *Ans.* 1 *lb.* $\frac{1}{2\,7}$

(5) If $\frac{3}{5}$ ell of Holland cost $\frac{1}{3}$ £, what will $12\frac{2}{3}$ clls cost at that rate? *Ans.* £7 0*s.* $8\frac{8}{9}$*d.*

(6) If $12\frac{1}{2}$ yards of cloth cost 15s. 9d., what will $48\frac{1}{4}$ cost at the same rate? *Ans.* £3 0*s.* $9\frac{2\,7}{5\,9}$*d.*

(7) If $\frac{9}{10}$ of a cwt. cost 284s., what will $7\frac{1}{2}$ cwt. cost at the same rate? *Ans.* £118 6*s.* 8*d.*

(8) If 3 yards of broad cloth cost £$2\frac{4}{5}$, what will $10\frac{2}{7}$ yards cost? *Ans.* £9 12*s.*

(9) If $\frac{1}{4}$ of a yard cost $\frac{2}{3}$ of a £, what will $\frac{3}{5}$ of an ell English come to at the same rate? *Ans.* £2

(10) If 1 lb. of cochineal cost £1 5s., what will $36\frac{7}{10}$ lb. come to? *Ans.* £45 17*s.* 6*d.*

(11) If 1 yard of broad cloth cost $15\frac{5}{8}$s., what will 4 pieces cost, each containing $27\frac{3}{7}$ yards? *Ans.* £85 14*s.* $3\frac{3}{4}$*d.*

(12) Bought $3\frac{1}{2}$ pieces of silk, each containing $24\frac{3}{8}$ clls, at 6s. $0\frac{3}{4}$d. per ell; what will the whole quantity cost?
Ans. £25 17*s.* $2\frac{3\,1}{6\,4}$*d.*

(13) If 48 men can build a wall in $24\frac{1}{4}$ days, how many men can do the same in 192 days? *Ans.* $6\frac{1}{1\,6}$ *men*

(14) If $25\frac{2}{7}$s. will pay for the carriage of 1 cwt., $145\frac{1}{4}$ miles, how far may $6\frac{1}{2}$ cwt. be carried for the same money?
Ans. $22\frac{9}{2\,6}$ *miles*

(15) If $3\frac{1}{4}$ yards of cloth that is $1\frac{1}{5}$ yard wide be sufficient to make a cloak, how much must I have of that sort which is $\frac{4}{5}$ yard wide to make another of the same size?
Ans. $4\frac{7}{8}$ *yards*

(16) If 3 men can do a piece of work in $4\frac{1}{2}$ hours, in how many hours will 10 men do the same work? *Ans.* $1\frac{7}{2\,0}$ *hour*

(17) If a penny loaf weigh 7 oz. when a bushel of wheat cost 5s. 6d., what is the bushel worth when the penny loaf weighs but $2\frac{1}{2}$ oz.? *Ans.* 15*s.* $4\frac{4}{5}$*d.*

(18) What quantity of silk that is $\frac{3}{4}$ yard wide will line $7\frac{1}{2}$ yards of cloth $1\frac{1}{2}$ yard wide? *Ans.* 15 *yds.*

THE RULE OF THREE IN DECIMALS.

RULE.—State and work the question as in whole numbers, pointing the decimals according to the rules for multiplication and division of decimals.

EXAMPLES.—XLIV.

(1) If $26\frac{1}{2}$ yards cost £3 16s. 3d., what will $32\frac{1}{4}$ yards come to?

Yds.	Yds.	£
26·5	: 32·25	: : 3·8125
		3225

26·5)122·953125(4·63974

Ans. £4·63974 = £4 12*s.* $9\frac{1}{2}$*d.*

(2) What will the pay of 540 men come to at £1 5s 6d. per man? *Ans.* £688 10*s.* 0*d.*

(3) If $7\frac{3}{4}$ yards of cloth cost £2 12s. 9d., what will $140\frac{1}{2}$ yards of the same cost? *Ans.* £47 16*s.* 3·6*d.*

(4) If a chest of sugar, weighing 7 cwt. 2 qrs. 14 lb., cost £36 12s. 9d., what will 2 cwt. 1 qr. 21 lb. of the same cost? *Ans.* £11 14*s.* 2*d.* 3·5 *q.*

(5) A grocer buys 24 ton, 12 cwt. 2 qrs. 14 lb. 12 oz. of tobacco for £3678 6s. 4d.; what will 1 oz. come to? *Ans.* 1*d.*

(6) What will $326\frac{1}{4}$ lb. of tobacco come to when $1\frac{1}{2}$ lb. is sold for 3s. 6d.? *Ans.* £38 1*s.* 3*d.*

(7) What is the worth of 19 oz. 3 dwt. 5 gr. of gold at £2 19s. per oz.? *Ans.* £56 10*s.* 5*d.* 2·3 *q.*

(8) What is the worth of $827\frac{3}{4}$ yards of painting at $10\frac{1}{2}$d. per yard? *Ans.* £36 4*s.* 3*d.* 1·5 *q.*

(9) If I lent my friend £34 for $\frac{5}{8}$ of a year, how much ought he to lend me $\frac{5}{12}$ of a year to requite my kindness?

Ans. £51

(10) If $\frac{3}{4}$ of a yard of cloth that is $2\frac{1}{4}$ yards broad make a garment, how much that is $\frac{4}{5}$ of a yard wide will make the same? *Ans.* 2·109375 *yds.*

(11) If 1 oz. of silver costs 5s. 6d., what is the price of a tankard that weighs 1 lb. 10 oz. 10 dwt. 4 gr.?

Ans. £6 3*s.* 9*d.* 2·2 *q.*

(12) If 1 lb. of tobacco cost 1s. 3d., what cost 3 hhds., weighing together 15 cwt. 1 qr. 19 lb.? *Ans.* £107 18*s.* 9*d.*

(13) If 1 cwt. of currants cost £2 9s. 6d., what will 45 cwt. 3 qrs. 14 lb. cost at the same rate?

Ans. £113 10*s.* 9*d.* 3 *q.*

(14) Bought 6 chests of sugar, each 6 cwt. 3 qrs., at £2 16s. per cwt., what do they come to? *Ans.* £113 8*s.*

(15) Bought a tankard for £10 12s., at the rate of 5s. 4d. per oz.; what was the weight? *Ans.* 39 *oz.* 15 *dwt.*

(16) Gave £187 3s. 3d. for 25 cwt. 3 qrs. 14 lb. of tobacco; at what rate did I buy it per lb.? *Ans.* 1*s.* 3*d.* 2 *q.*

(17) Bought 29 lb. 4 oz. of coffee for £10 11s. 3d.; what is the value of 3 lb.? *Ans.* £1 1*s.* 8*d.*

(18) If I gave 1s. 1d. for $3\frac{1}{2}$ lb. of cheese, what will be the value of 1 cwt.? *Ans.* £1 14*s.* 8*d.*

COMPOUND PROPORTION, OR DOUBLE RULE OF THREE,

Is so called because it is compounded of two or more single proportions; and each example may be worked or proved by two or more statings in single rule of three. Each question consists of two parts or *cases*, one a *supposition* or analogous case (*e.g.* "if 15 horses eat 9 bushels of oats in 6 days"); the other a *demand* or case in point (*e.g.* "how many horses will eat 24 bushels in 8 days?") Each *case* will also consist of two parts—one part being *cause* or *causes* of loss or gain, increase or decrease, action or passion (*e.g.* the 15 horses and the 6 days in the first case; *or* the required number of horses and the 8 days in the second case); the other part being the *effects* or results of those causes (*e.g.* the 9 bushels consumed in the first case; *or* the 24 bushels consumed in the second case). Then the proportion will be

As Causes in first case : Causes in second case : : Effects in first case : Effects in second case.

A blank will occur in one of these four terms in the place of the answer. The rule, then, is—

RULE.—Multiply the product of the causes in first case by the product of the effects in second case; multiply also the

product of the causes in second case by the product of the effects in first case; of the two results take that which contains the blank for the divisor, and the other for the dividend; the quotient will be the answer.

NOTE.—This rule applies equally to Integers, to Vulgar Fractions, and to Decimals.

EXAMPLES.—XLV.

(1) If 15 horses eat 9 bushels of oats in 6 days, how many will consume 24 bushels in 8 days?

1st Cause = 15 horses, and 6 days.
2nd Cause = Answer, and 8 days.
1st Effect = 9 bushels.
2nd Effect = 24 bushels.

$$\frac{15 \times 6 \times 24}{8 \times 9} = 30 \text{ horses. } \textit{Ans.}$$

(2) If 2 horses eat 8 bushels of oats in 16 days, how many horses will eat 3000 qrs. in 24 days? *Ans.* 4000

(3) If £100 in 12 months gain £7 interest, what is the interest of £571 for 6 years?

Ans. £239 16*s.* $4\frac{3}{4}$*d.*—20 *rem.*

(4) If 14 horses eat 56 bushels of oats in 16 days, how many bushels will be sufficient for 20 horses 24 days?

Ans. 120

(5) If 8 men mow 112 acres of grass in 14 days, how many men can mow 2000 acres in 10 days? *Ans.* 200

(6) If 40 acres of grass be mowed by 8 men in seven days, how many acres can be mowed by 24 men in 28 days?

Ans. 480

(7) If a family consisting of 7 persons drink 2 kilderkins of beer in 12 days, how much, in the same proportion, will serve another family of 14 persons for 8 days?

Ans. 2 *kil.* 12 *gal.*

(8) If £100 in 12 months gain £6 interest, how much will £75 gain in 9 months? *Ans.* £3 7*s.* 6*d.*

(9) If the carriage of 60 cwt. for 20 miles cost £14 10*s.*, what weight can I have carried 30 miles for £5 8*s.* 9*d.* at the same rate? *Ans.* 15 *cwt.*

(10) If £100 in 12 months gain £6 interest, what principal will gain £3 7s. 6d. in 9 months? *Ans.* £75

(11) If I pay 10s. for the carriage of 2 tons 6 miles, what will be the carriage of 12 tons 17 cwt. for 17 miles?

Ans. £9 2*s.* $0\frac{1}{2}d.$

(12) If 136 soldiers consume 351 quarters of wheat in 108 days, how many quarters will 11232 soldiers consume in 56 days? *Ans.* 15031—864 *rem.*

(13) If a carrier receives £2 2s. for the carriage of 3 cwt. 150 miles, how much ought he to receive for the carriage of 7 cwt. 3 qr. 14 lb. for 50 miles? *Ans.* £1 16*s.* 9*d.*

(14) If a regiment consisting of 939 soldiers consume 351 quarters of wheat in 168 days, how many soldiers will consume 1404 quarters in 56 days? *Ans.* 11268

PRACTICE

Is so called from the general use thereof by persons concerned in trade and business.

All questions in this rule are performed by taking aliquot parts, which is a compendious method of finding the value of goods, when the price of an integer is given.

TABLE.

Of a Pound.			*Of a Shilling.*		*Of a Ton.*		*Of a Cwt.*		
s.	*d.*		*d.*		*cwt.*		*qrs.*	*lb.*	
10	0	is $\frac{1}{2}$	6	is $\frac{1}{2}$	10	is $\frac{1}{2}$	2 or	56	is $\frac{1}{2}$
6	8	... $\frac{1}{3}$	4	... $\frac{1}{3}$	5	... $\frac{1}{4}$	1 or	28	... $\frac{1}{4}$
5	0	... $\frac{1}{4}$	3	... $\frac{1}{4}$	4	... $\frac{1}{5}$		14	... $\frac{1}{8}$
4	0	... $\frac{1}{5}$	2	... $\frac{1}{6}$	$2\frac{1}{2}$	... $\frac{1}{8}$			
3	4	... $\frac{1}{6}$	$1\frac{1}{2}$	... $\frac{1}{8}$	2	... $\frac{1}{10}$			
2	6	... $\frac{1}{8}$	1	... $\frac{1}{12}$					
2	0	... $\frac{1}{10}$							
1	8	... $\frac{1}{12}$							

Of a Quarter.		
14 lb.	is	$\frac{1}{2}$
7	...	$\frac{1}{4}$
4	...	$\frac{1}{7}$
$3\frac{1}{2}$	...	$\frac{1}{8}$

When the price is farthings only, divide the quantity by the aliquot parts in a penny, and the quotient will be the answer in pence, which bring into pounds.

EXAMPLES.—XLVI.

(1) $\frac{1}{4}$ is $\frac{1}{4}$ 5704 lb. at $\frac{1}{4}d.$

12)1426

2,0)11,8 10

£5 18 10

(2) 3392 at $\frac{1}{4}$d. *Ans.* £3 10*s.* 8*d.*
(3) 7695 at $\frac{1}{2}$d. *Ans.* £16 0*s.* $7\frac{1}{2}d.$
(4) 6547 at $\frac{3}{4}$d. *Ans.* £20 9*s.* $2\frac{1}{4}d.$
(5) 8361 at $\frac{1}{4}$d. *Ans.* £8 14*s.* $2\frac{1}{4}d.$
(6) 5740 at $\frac{1}{2}$d. *Ans.* £11 19*s.* 2*d.*
(7) 4573 at $\frac{3}{4}$d. *Ans.* £14 5*s.* $9\frac{3}{4}d.$

When the price is pence and farthings, divide by the aliquot parts of a shilling, and take parts with what remains; add the quotients together, will give the answer in shillings, which bring into pounds.

NOTE.—An aliquot part is a number which is contained so many times in another without a remainder.

In taking the various aliquot parts of a given price, the sum of those parts is the whole price. On the same principle, the sum of the quotients resulting from them, united with the product of the quantity, multiplied by the higher denomination in the price, will be the answer.

When the given quantity does not exceed three figures, in most instances the answer can be easier obtained by multiplication of money.

EXAMPLES.—XLVII.

(1)

1d. is $\frac{1}{12}$ 3751 at $1\frac{1}{4}$d.

$\frac{1}{4}$ is $\frac{1}{4}$ 312·7
78·1$\frac{3}{4}$

2,0)39,0·8$\frac{3}{4}$

£19 10 8$\frac{3}{4}$

(2)

$1\frac{1}{2}$d. $\frac{1}{8}$ 6421 at $1\frac{3}{4}$d.

$\frac{1}{4}$ $\frac{1}{6}$ 802 7$\frac{1}{2}$
133 9$\frac{1}{4}$

2,0)93,6 4$\frac{3}{4}$

£46 16 4$\frac{3}{4}$

(3) 7210 at $2\frac{1}{4}$d. *Ans.* £67 11*s.* $10\frac{1}{2}d.$
(4) 2147 at $3\frac{1}{2}$d. *Ans.* £31 6*s.* $2\frac{1}{2}d.$

(5) 3257 at 4d. *Ans.* £54 5*s.* 8*d.*
(6) 2107 at $4\frac{3}{4}$d. *Ans.* £41 14*s.* $0\frac{1}{4}$*d.*
(7) 3210 at 5d. *Ans.* £66 17*s.* 6*d.*
(8) 2715 at $5\frac{1}{4}$d. *Ans.* £59 7*s.* $9\frac{3}{4}$*d.*
(9) 3271 at 6d. *Ans.* £81 15*s.* 6*d.*
(10) 3250 at $6\frac{1}{2}$d. *Ans.* £88 0*s.* 5*d.*
(11) 3271 at 7d. *Ans.* £95 8*s.* 1*d.*
(12) 3714 at $7\frac{3}{4}$d. *Ans.* £119 18*s.* $7\frac{1}{2}$*d.*
(13) 2710 at 8d. *Ans.* £90 6*s.* 8*d.*
(14) 3514 at $8\frac{1}{4}$d. *Ans.* £120 15*s.* $10\frac{1}{2}$*d.*
(15) 5272 at 9d. *Ans.* £197 14*s.*
(16) 7924 at $9\frac{1}{2}$d. *Ans.* £313 13*s.* 2*d.*
(17) 6325 at 10d. *Ans.* £263 10*s.* 10*d.*
(18) 7291 at $10\frac{3}{4}$d. *Ans.* £326 11*s.* $6\frac{1}{4}$*d.*
(19) 3256 at 11d. *Ans.* £149 4*s.* 8*d.*
(20) 7972 at $11\frac{3}{4}$d. *Ans.* £390 5*s.* 11*d.*

When the price is more than one shilling, and less than two, take parts with so much of the price as is more than a shilling, as in the last case, and add them to the given quantity; the total is shillings, which bring into pounds.

EXAMPLES.—XLVIII.

(1)

$\frac{1}{4}$ is $\frac{1}{48}$ 2106 at $12\frac{1}{4}$d.
43 $10\frac{1}{2}$

2,0)214,9 $10\frac{1}{2}$

£107 9 $10\frac{1}{2}$

(2)

$\frac{1}{2}$ is $\frac{1}{24}$ 3715 at $12\frac{1}{2}$d.
154 $9\frac{1}{2}$

2,0)3869 $9\frac{1}{2}$

£193 9 $9\frac{1}{2}$

(3)

$\frac{3}{4}$ is $\frac{1}{16}$ 637 at $12\frac{3}{4}$d.
39 $9\frac{3}{4}$

2,0)67,6 $9\frac{3}{4}$

£33 16 $9\frac{3}{4}$

(4) 3215 at 1*s.* $1\frac{1}{4}$d. *Ans.* £177 9*s.* $10\frac{3}{4}$*d.*
(5) 9254 at 1*s.* $2\frac{1}{2}$d. *Ans.* £559 1*s.* 11*d.*

(6) 7591 at 1s. 3d. *Ans.* £474 8*s.* 9*d.*
(7) 3254 at 1s. $3\frac{3}{4}$d. *Ans.* £213 10*s.* $10\frac{1}{2}d.$
(8) 3270 at 1s. $4\frac{1}{4}$d. *Ans.* £221 8*s.* $1\frac{1}{2}d.$
(9) 2597 at 1s. $5\frac{1}{2}$d. *Ans.* £189 7*s.* $3\frac{1}{2}d.$
(10) 7925 at 1s. $6\frac{3}{4}$d. *Ans.* £619 2*s.* $9\frac{3}{4}d.$
(11) 9271 at 1s. 7d. *Ans.* £733 19*s.* 1*d.*
(12) 7210 at 1s. $7\frac{1}{4}$d. *Ans.* £578 6*s.* $0\frac{1}{2}d.$
(13) 7104 at 1s. $8\frac{1}{2}$d. *Ans.* £606 16*s.* 0*d.*
(14) 1004 at 1s. $8\frac{3}{4}$d. *Ans.* £86 16*s.* 1*d.*
(15) 2571 at 1s. $9\frac{1}{4}$d. *Ans.* £227 12*s.* $9\frac{3}{4}d.$
(16) 2104 at 1s. $9\frac{1}{2}$d. *Ans.* £188 9*s.* 8*d.*
(17) 1007 at 1s. $10\frac{3}{4}$d. *Ans.* £95 9*s.* $1\frac{1}{4}d.$
(18) 5000 at 1s. 11d. *Ans.* £479 3*s.* 4*d.*
(19) 2105 at 1s. $11\frac{1}{4}$d. *Ans.* £203 18*s.* $5\frac{1}{4}d.$
(20) 1006 at 1s. $11\frac{1}{2}$d. *Ans.* £98 10*s.* 1*d.*
(21) 2705 at 1s. $11\frac{3}{4}$d. *Ans.* £267 13*s.* $7\frac{3}{4}d.$

When the price consists of even shillings under 20, multiply the quantity by half the shillings, doubling the units figure for shillings, and the rest of the product will be pounds.

EXAMPLES.—XLIX.

(1) 2750 at 2s.
1

£275 0

(2) 3254 at 4s.
2

£650 16

(3) 2710 at 6s. *Ans.* £813
(4) 1572 at 8s. *Ans.* £628 16*s.*
(5) 2102 at 10s. *Ans.* £1051
(6) 2101 at 12s. *Ans.* £1260 12*s.*
(7) 5271 at 14s. *Ans.* £3689 14*s.*
(8) 3123 at 16s. *Ans.* £2498 8*s.*
(9) 1621 at 18s. *Ans.* 1458 18*s.*

When the price consists of odd shillings under 20, multiply the quantity by the price, and divide by 20.

EXAMPLES.—L.

(1)

3270 at 3s.

3

2,0)981,0

£490 10 0

(2) 3271 at 5s — *Ans.* £817 15*s.*
(3) 2715 at 7s. — *Ans.* £950 5*s.*
(4) 3214 at 9s. — *Ans.* £1446 6*s.*
(5) 3179 at 13s. — *Ans.* £2066 7*s.*
(6) 3142 at 17s. — *Ans.* £2670 14*s.*
(7) 7157 at 19s. — *Ans.* £6799 3*s.*

When the price is shillings and pence, and they the aliquot parts of a pound, divide by the aliquot parts, and the quotient will be the answer in pounds.

For shillings, pence, and farthings, if the shillings and pence be not the aliquot part of a pound, multiply by the shillings, and take parts with the pence and farthings; add them together, and divide by 20.

EXAMPLES.—LI.

(1)

6s. 8d. $\frac{1}{3}$)2710 at 6s. 8d.

£903 6 8

(2)

2d. $\frac{1}{6}$)2710 at 3s. 2d.

3

8130

451 8

2,0)858,1 8

£429 1 8

(3) 7150 at 1s. 8d. — *Ans.* £595 16*s.* 8*d.*
(4) 2715 at 2s. 6d. — *Ans.* £339 7*s.* 6*d.*
(5) 3150 at 3s. 4d. — *Ans.* £525 0*s.* 0*d.*

(6) 2710 at 6s. 8d. *Ans.* £903 6*s.* 8*d.*
(7) 7514 at 4s. 7d. *Ans.* £1721 19*s.* 2*d.*
(8) 3271 at 5s. 9¼d. *Ans.* £943 16*s.* 4¾*d.*
(9) 2103 at 15s. 4½d. *Ans.* £1616 13*s.* 7½*d.*
(10) 7152 at 17s. 6¾d. *Ans.* £6280 7*s.* 0*d.*
(11) 3715 at 9s. 4½d. *Ans.* £1741 8*s.* 1½*d.*
(12) 3210 at 15s. 7¾d. *Ans.* £2511 3*s.* 1½*d.*
(13) 7251 at 14s. 8¼d. *Ans.* £5324 19*s.* 0¾*d.*
(14) 2710 at 19s. 2½d. *Ans.* £2602 14*s.* 7*d.*

When the price is pounds and shillings, and the shillings even, multiply the quantity by the pounds, and again by half the shillings, doubling the units figure for shillings, and add them together.

For pounds, shillings, pence, and farthings, if under five pounds, multiply by the shillings contained in the pounds and shillings, and take parts with the rest; add them together, and divide by 20.

For sums above five pounds, multiply the quantity by the pounds, and take parts with the rest; the total of the divisors will be the answer.

EXAMPLES.—LII.

(1)

			£	*s.*	*d.*		*s.*	*d.*
4	⅕	7215 at	7	4	0		2	6
		7						
		50505						
		1443					6	⅕
		£51948						

	2104 at	£ *s.* *d.* 5 3 0
	5	
	10520	
	263	
⅛	52 12	
	£10835 12	

(2)

(3) 3125 at £1 17s. 0d. *Ans.* £5781 5*s.* 0*d.*
(4) 2107 at £1 13s. 0d. *Ans.* £3476 11*s.* 0*d.*
(5) 3215 at £4 6s. 8d. *Ans.* £13931 13*s.* 4*d.*
(6) 2154 at £7 1s. 3d. *Ans.* £15212 12*s.* 6*d.*
(7) 2701 at £2 3s. 4d. *Ans.* £5852 3*s.* 4*d.*
(8) 2715 at £1 17s. 2½d. *Ans.* £5051 0*s.* 7½*d.*
(9) 2517 at £3 15s. 2¼d. *Ans.* £9462 6*s.* 11¼*d.*

(10) 3210 at £1 18s. $6\frac{3}{4}$d. *Ans.* £6189 5*s.* $7\frac{1}{2}$*d.*
(11) 2157 at £2 7s. $4\frac{1}{2}$d. *Ans.* £5109 7*s.* $10\frac{1}{2}$*d.*
(12) 589 at £8 19s. 5d. *Ans.* £5283 16*s.* 5*d.*
(13) 2716 at £16 17s. $3\frac{1}{2}$d. *Ans.* £45804 4*s.* 2*d.*
(14) 5037 at £25 19s. $8\frac{3}{4}$d. *Ans.* £130893 15*s.* $9\frac{3}{4}$*d.*

When the quantity consists of several denominations, multiply the price by the integers, and take parts with the rest; the total of the quotients will be the answer.

EXAMPLES.—LIII.

(1) At £3 17s. 6d. per cwt., what is the value of 25 cwt. 2 qr. 14 lb. of tobacco? *Ans.* £99 5*s.* $11\frac{1}{4}$*d.*

qr.		£	*s.*	*d.*
2	$\frac{1}{2}$	3	17	6
				5
		19	7	6
				5
lb.		96	17	6
14	$\frac{1}{4}$	1	18	9
			9	$8\frac{1}{4}$
		99	5	$11\frac{1}{4}$

(2) Hops at £4 5s. 8d. per cwt., what must be given for 72 cwt. 1 qr. 13 lb.? *Ans.* £310 3*s.* 2*d.*
(3) At £1 1s. 4d. per cwt., what is the value of 27 cwt. 2 qr. 15 lb. of raisins? *Ans.* £29 9*s.* $6\frac{1}{4}$*d.*
(4) Tobacco at £3 17s. 10d. per cwt., what is the worth of 97 cwt. 15 lb.? *Ans.* £378 0*s.* 3*d.*
(5) Soap at £3 11s. 6d. per cwt., what is the value of 53 cwt. 17 lb.? *Ans.* £190 0*s.* 4*d.*
(6) Bought sugar at £3 14s. 6d. per cwt., what did I give for 15 cwt. 1 qr. 10 lb.? *Ans.* £57 2*s.* 9*d.*
(7) Sold 56 cwt. 1 qr. 17 lb. of sugar, at £2 15s. 9d. per cwt., what does it come to? *Ans.* £157 4*s.* $4\frac{1}{4}$*d.*
(8) Sold 85 cwt. 1 qr. 10 lb. of cheese, at £1 7s. 8d. per cwt., what does it come to? *Ans.* £118 1*s.* $0\frac{1}{4}$*d.*

(9) At £4 14s. 6d. the cwt., what is the value of 37 cwt. 2 qr. 13 lb. of double refined sugar? *Ans.* £177 14*s.* 8½*d.*

(10) At £1 4s. 9d. per cwt., what comes 17 cwt. 1 qr. 17 lb. of cheese to? *Ans.* £21 10*s.* 8*d.*

TARE AND TRET

Are certain allowances made to merchants and wholesale dealers on purchasing goods by weight.

Gross weight is the whole weight of the goods, and that which contains them.

Tare is an allowance for the weight of the box, barrel, bag, &c., which contains the goods, and is either at so much per box, barrel, bag, &c., so much per cwt., or so much in the whole.

Tret is an allowance for waste, dust, &c., and is usually 4 lb. per 104 lb. to the purchaser.

Cloff is a further allowance of 2 lb. on every 3 cwt. for waste or dust, only on particular articles.

Suttle is when only part of the allowances has been made.

Net, or *neat weight*, is when all the allowances have been deducted.

When the tare is at so much in the whole weight, subtract it from the gross, and the remainder is neat.

When tare is at so much per bag, barrel, &c., multiply the tare in each by the number of bags, &c., and subtract the product from the gross; the remainder is neat.

EXAMPLES.—LIV.

(1) In 8 frails of raisins, each weighing 5 cwt. 1 qr. 15 lb., tare 20 lb. each frail, how much neat?

lb.		*cwt.*	*qr.*	*lb.*			
20		5	1	15			
8				8			
28) 160 (5 =	*cwt.* 1	*qr.* 1	*lb.* 20	43	0	8	*gross*
140				1	1	20	*tare*
20		41	2	16			*neat*

NOTE.—*Ounces* are invariably rejected, except on very valuable commodities.

(2) What is the neat weight of 5 hhds. of tobacco, weighing gross 75 cwt. 1 qr. 14 lb., tare in the whole 752 lb.?

Ans. 68 *cwt.* 2 *qr.* 18 *lb.*

(3) In 16 bags of pepper, each 85 lb. 4 oz. gross, tare per bag 3 lb. 5 oz., how many pounds neat? *Ans.* 1311

(4) What is the neat weight of 25 hhds. of tobacco, weighing gross 163 cwt. 2 qr. 15 lb., tare 100 lb. per hhd.?

Ans. 141 *cwt.* 1 *qr.* 7 *lb.*

(5) In 7 frails of raisins, each weighing 5 cwt. 2 qrs. 5 lb. gross, tare 23 lb. per frail, how much neat weight?

Ans. 37 *cwt.* 1 *qr.* 14 *lb.*

(6) In 75 barrels of figs, each 2 qr. 27 lb. gross, tare in the whole 597 lb., how much neat weight? *Ans.* 50 *cwt.* 1 *qr.*

When the tare is at so much per cwt., find the whole amount of the gross, and divide it by the aliquot parts that the tare is at per cwt.; subtract the quotient from the gross, the remainder is neat.

EXAMPLES.—LV.

(1) What is the neat weight of 9 hhds. of nutmegs, each weighing gross 8 cwt. 3 qr. 14 lb., tare 16 lb. per cwt.?

	cwt.	*qr.*	*lb.*	
	8	3	14	
			9	
16 *lb.* = $\frac{1}{7}$	79	3	14	*gross*
	11	1	18	*tare*
	68	1	24	*neat*

(2) In 25 barrels of figs, each 2 cwt. 1 qr. gross, tare per cwt. 16 lb., how much neat weight? *Ans.* 48 *cwt.* 24 *lb.*

(3) What is the neat weight of 18 butts of currants, each 8 cwt. 2 qr. 5 lb., tare at 14 lb. per cwt.?

Ans. 134 *cwt.* 2 *qr.* 9 *lb.*

When Tret is allowed with Tare, divide the suttle by 26 (because 4 lb. is the 26th of 104), the quotient is the tret, which subtract from the suttle, the remainder is neat.

EXAMPLES.—LVI.

(1) In one butt of currants, weighing 12 cwt. 2 qr. 24 lb. gross, tare 14 lb. per cwt., tret 4 lb. per 104 lb., how much neat?

lb.	*cwt.*	*qr.*	*lb.*	
$14 = \frac{1}{8}$)	12	2	24	*gross*
	1	2	10	*tare*
lb.				
$4 = \frac{1}{26}$)11	0		14	*suttle*
	1		19	*tret*
	10	2	23	*neat*

(2) In 7 cwt. 3 qr. 27 lb. gross, tare 36 lb., tret 4 lb. per 104, how many pounds neat? *Ans.* 826

(3) In 152 cwt. 1 qr. 3 lb. gross, tare 10 lb. per cwt., tret as usual, how much neat? *Ans.* 133 *cwt.* 1 *qr.* 12 *lb.*

When Cloff is allowed, multiply the cwt. of the second suttle by 2, and divide the product by 3; the quotient will be *pounds* cloff, which subtract from the suttle, the remainder is neat.

Or, divide the second suttle by 168 (because 2 lb. is 168th part of 3 cwt.), the quotient will be cloff.

EXAMPLES.—LVII.

(1) What is the neat weight of 15 cwt. 3 qr. 20 lb. tobacco, tare 7 lb. per cwt., tret 4 lb. per 104 lb., and cloff 2 lb. for every 3 cwt.?

	cwt.	*qr.*	*lb.*	
$7 = \frac{1}{16}$	15	3	20	*gross*
		3	27	*tare*
	26) 14	3	21	*suttle*
14 *cwt.*		2	8	*tret*
2				
3)28	14	1	13	*suttle*
9 *lb. cloff*			9	*cloff*
	14	1	4	*neat*

(2) In 7 hhds. tobacco, each gross 5 cwt. 2 qr. 7 lb., tare 8 lb. per cwt., tret and cloff as usual, how much neat weight?

Ans. 34 *cwt.* 2 *qr.* 9 *lb.*

(3) Drugs 117 cwt. 21 lb. gross, tare 173 lb., tret 4 lb. per 104, cloff 2 lb. for 3 cwt., how much neat?

Ans. 110 *cwt.* 2 *qr.* 4 *lb.*

NOTE.—Cloff is ascertained by the above rule when the allowance is 2 lb. per 3 cwt., but when different, another divisor must be substituted in proportion to the given rate.

SIMPLE INTEREST

Is the consideration or profit allowed for the loan of money, and is greater or less in proportion to the sum lent, the time for which it is lent, and the rate per cent. at which it is lent.

The *principal* is the sum lent, for which interest is to be received.

The *rate per cent.* is a certain sum agreed on between the borrower and the lender, to be paid for every £100, for the use of the principal for twelve months.

The *amount* is the principal and interest added together.

The method of computing Interest is also applied to Commission, Brokerage, Stocks, Insurance, &c.

To find the Interest of any Sum of Money for a Year.

RULE.—Multiply the principal by the rate per cent.; that product divided by 100, will give the interest required.

For several Years.

RULE.—Multiply the interest of one year by the number of years, and the product will be the answer. Or,

Multiply the principal by the rate per cent. and the years, and divide by 100.

EXAMPLES.—LVIII.

(1) What is the interest of £375 for a year, at 5 per cent. per annum?

5

18|75
20

15|00

Ans. £18 15*s.*

(2) What is the interest of £268 for one year, at 4 per cent. per annum? *Ans.* £10 14*s.* $4\frac{4}{5}$*d.*

(3) What is the interest of £945 10s. for one year, at 4 per cent. per annum? *Ans.* £37 16*s.* $4\frac{4}{5}$*d.*

(4) What is the interest of £547 15s., at 3 per cent. per annum, for three years? *Ans.* £49 5*s.* $11\frac{1}{4}$*d.*

(5) What is the interest of £254 17s. 6d. for five years, at 4 per cent. per annum? *Ans.* £50 19*s.* 6*d.*

(6) What is the interest of £556 13s. 4d., at 5 per cent. per annum, for five years? *Ans.* £139 3*s.* 4*d.*

NOTE.—When the rate per cent. is an aliquot part of 100, or can easily be formed into several such parts dependent on 100, divide the principal as in Practice. This will produce the interest for one year.

When the Rate per Cent. consists of Pounds, and $\frac{1}{4}$, $\frac{1}{2}$, *or* $\frac{3}{4}$ *of a Pound.*

RULE.—Multiply the principal by the rate per cent., and take parts with the fractional parts from the principal, which added to the product, and divided by 100, will give the interest for one year.

When the Time consists of Years, and $\frac{1}{4}$, $\frac{1}{2}$, *or* $\frac{3}{4}$ *of a Year.*

RULE.—Multiply the interest of one year by the number of years, and take parts with the fractional parts from one year's interest, which add to the interest of the several years.

EXAMPLES.—LIX.

(1) What is the interest of £175 17s., at $4\frac{1}{2}$ per cent., for $2\frac{3}{4}$ years?

$\frac{1}{2}$	£175	17	
		4	
	703	8	
	87	18	6
	791	6	6
		20	
	1826		
		12	
	3	18	

$\frac{1}{2}$	$\frac{1}{2}$	£7	18 3
			2
		15	16 6
$\frac{1}{4}$	$\frac{1}{2}$	3	19 $1\frac{1}{2}$
		1	19 $6\frac{3}{4}$

Ans. £21 15 $2\frac{1}{4}$

(2) What is the interest of £325 7s. 6d., at 6 per cent. per annum, for $3\frac{1}{2}$ years? *Ans.* £68 6*s.* $6\frac{1}{4}$*d.*

(3) What is the interest of £397 9s. 5d., at $3\frac{1}{2}$ per cent. per annum, for $2\frac{1}{4}$ years? *Ans.* £31 6*s.*

(4) What is the interest of £547 2s. 4d., at 4 per cent. per annum, for $5\frac{1}{2}$ years? *Ans.* £120 7*s.* $3\frac{1}{4}$*d.*

(5) What is the interest of £576 2s. 7d., at $4\frac{1}{2}$ per cent. per annum, for $7\frac{1}{4}$ years? *Ans.* £187 19*s.* $1\frac{1}{2}$*d.*

(6) What is the interest of £479 5s., at 5 per cent. per annum, for $5\frac{1}{4}$ years? *Ans.* £125 16*s.* $0\frac{3}{4}$*d.*

(7) What is the interest of £279 13s. 6d., at $5\frac{1}{4}$ per cent. per annum, for $3\frac{1}{2}$ years? *Ans.* £51 7*s.* 10*d.*

Interest for Weeks.

RULE.—As 52 weeks are to the number of weeks given, so is the interest of the given sum for a year to the interest required.

EXAMPLES.—LX.

(1) What is the interest of £379 13s. 2d. for 4 weeks, at 4 per cent. per annum?

£379 13 $2 \times 4 \div 100 =$ £15 3 $8\frac{1}{2}$—88

As 52 weeks : 4 weeks : : £15 3 $8\frac{1}{2}$: £1 3 $4\frac{3}{10}$ *Ans.*

(2) What is the interest of £259 13s. 5d. for 20 weeks, at 5 per cent. per annum? *Ans.* £4 19*s.* $10\frac{9}{25}d.$

(3) What is the amount of £375 6s. 1d. for 12 weeks, at $4\frac{1}{2}$ per cent. per annum? *Ans.* £379 4*s.* $0\frac{1}{4}d.$

(4) What is the amount of £256 5s. 3d. for 25 weeks, at $2\frac{3}{4}$ per cent. per annum? *Ans.* £259 13*s.*

Interest for Days.

As 365 days are to the number of days given, so is the interest of the given sum for a year to the interest required.

(5) What is the interest of £240 for 120 days, at 4 per cent. per annum?

£240 × 4 ÷ 100 = £9 12

As 365 days : 120 days : : £9 12 : £3 3 $1\frac{1}{4}$ 335 *rem. Ans.*

(6) What is the interest of £379 5s. 4d. for 3 years and 75 days, at 5 per cent. per annum? *Ans.* £60 15*s.* 8*d.*

(7) At $5\frac{1}{2}$ per cent. per annum, what is the interest of £985 2s. 7d. for 5 years, 127 days? *Ans.* £289 15*s.* 2*d.*

(8) What is the interest of £2726 1s. 4d., at $4\frac{1}{2}$ per cent. per annum, for 3 years, 154 days? *Ans.* £419 15*s.* $6\frac{1}{4}d.$

When the Amount, Time, and Rate per Cent. are given, to find the Principal.

Rule.—As the amount of £100 at the rate and time given is to the amount given, so is £100 to the principal required.

EXAMPLES.—LXI.

(1) What principal being put to interest will amount to £402 10s., at 3 per cent. per annum, for 5 years?

£3 × 5 + 100 = £115 : £100 : : £402 10 : £350 *Ans.*

(2) What principal, being put to interest for 9 years, will amount to £734 8s., at 4 per cent. per annum? *Ans.* £540

(3) What principal, being put to interest for 7 years, at 5 per cent. per annum, will amount to £334 16s.?

Ans. £248

When the Principal, Rate per Cent., and Amount are given, to find the Time.

RULE.—As the interest of the principal for one year is to the whole interest, so is one year to the time required.

EXAMPLES.—LXII.

(1) In what time will £350 amount to £402 10s., at 3 per cent. per annum?

$350 \times 3 \cdot 100 = 10\ 10$ As £10 10 : £52 10 : : 1 yr. : 5 yrs.

£402 10
£350 0

£52 10 *Ans.* 5 *years*

(2) In what time will £540 amount to £734 8s., at 4 per cent. per annum? *Ans.* 9 *years*

(3) In what time will £248 amount to £334 16s., at 5 per cent. per annum? *Ans.* 7 *years*

When the Principal, Amount, and Time are given, to find the Rate per Cent.

RULE.—As the principal is to £100, so is the interest given to the interest on £100 for the same time at the same rate. Divide that interest by the time, and the quotient will be the rate per cent.

EXAMPLES.—LXIII.

(1) At what rate per cent. will £350 amount to £402 10s. in 5 years' time?

£402 10 As £350 : £100 : : £52 10 : £15
£350 0

£52 10 £15 ÷ 5 = 3 *per cent. Ans.*

(2) At what rate per cent. will £248 amount to £334 16s. in 7 years' time? *Ans.* 5 *per cent.*

(3) At what rate per cent. will £540 amount to £734 8s. in 9 years' time? *Ans.* 4 *per cent.*

COMPOUND INTEREST

Is the sum arising from the principal, and the interest as it becomes due added to it; each amount forming another principal, and the interest being calculated in succession accordingly.

Rule.—Find the first year's interest, which add to the principal; then find the interest of that sum, which add as before; repeating the same for the number of years, will give the amount.

Subtract the given sum from the last amount, and the remainder is the compound interest required.

EXAMPLES.—LXIV.

(1) What is the compound interest of £500, at 5 per cent. per annum, forborne 3 years?

£500	£500	£525	£551 5
5	25	26 5	27 11 3
25|00	525 = 1st yr.	551 5 = 2nd yr.	578 16 3 = 3rd yr.
	5	5	500 0 0 principal
	26|25	27|56 5	78 16 3 the
	20	20	compound interest
	5|00	11|25	
		12	
		3|00	*Ans.* £78 16*s.* 3*d.*

(2) What is the amount of £400, forborne $3\frac{1}{2}$ years, at 6 per cent. per annum, compound interest?

Ans. £490 13*s.* $11\frac{1}{4}$*d.*

(3) What will £650 amount to in 5 years, at 5 per cent. per annum, compound interest? *Ans.* £829 11*s.* $7\frac{1}{2}$*d.*

(4) What is the amount of £550 10s. for 3 years and 6 months, at 6 per cent. per annum, compound interest?

Ans. £675 6*s.* 5*d.*

(5) What is the compound interest of £764 for 4 years and 9 months, at 6 per cent. per annum?

Ans. £243 18*s.* 8*d.*

(6) What is the compound interest of £57 10s. 6d. for 5 years, 7 months, and 15 days, at 5 per cent. per annum?

Ans. £18 3*s.* $8\frac{1}{2}d.$

(7) What is the compound interest of £259 10s. for 3 years, 9 months, and 10 days, at $4\frac{1}{2}$ per cent. per annum?

Ans. £46 19*s.* $10\frac{1}{2}d.$

NOTE.—When the interest is paid half-yearly, take half the rate per cent. and twice the number of years; for quarterly payments, take a quarter of the rate per cent. and four times the number of years.

REBATE, OR DISCOUNT,

Is the abatement or allowance that is made on the payment of money before it is due, and is equal to the interest that the money actually paid would produce in the given time at the given rate.

NOTE.—This is what is called the true discount; banker's discount is simply the interest on the whole sum for the given time at the given rate. Three days (called Days of Grace) are always added to the time of a bill.

RULE.—As £100 with the interest for the time given is to the sum given, so is that interest to the discount required.

Subtract the discount from the given sum, and the remainder will be the present worth.

EXAMPLES.—LXV.

(1) What is the discount and present worth of £487 12s. for 6 months, at 6 per cent. per annum?

6m. is $\frac{1}{2}$)£6

3

100

103

As £103 : £487 12 : : £3 :

Ans. £14 4 $0\frac{1}{4}$—178 *the discount*

From £487 12 0 *given sum*

Take 14 4 $0\frac{1}{4}$ *the discount*

Ans. 473 7 $11\frac{3}{4}$ *present worth*

When the present worth only is required, say—As the

amount of £100 for the given time is to the given sum, so is £100 to the present worth, viz. :—

As £103 : £487 12 : : £100 : £473 7 $11\frac{3}{4}$

(2) What is the present worth of £500, payable in 10 months, at 5 per cent. per annum? *Ans.* £480

(3) How much ready money can I receive for a note of £75, due 15 months hence, at 5 per cent. per annum?

Ans. £70 11*s.* 9*d.*—375 *rem.*

(4) What is the present payment of £357 10s., which was agreed to be paid 9 months hence, at 5 per cent. per annum?

Ans. £344 11*s.* $6\frac{3}{4}$*d.*—375 *rem.*

(5) What is the discount of £275 10s. for 7 months, at 5 per cent. per annum? *Ans.* £7 16*s.* $1\frac{3}{4}$*d.*—95 *rem.*

(6) Bought goods to the value of £109 10s., to be paid at 9 months; what present money will discharge the same, if I am allowed 6 per cent. per annum discount?

Ans. £104 15*s.* $8\frac{1}{4}$*d.*—63 *rem.*

(7) What is the present worth of £527 9s. 1d., payable 7 months hence, at $4\frac{1}{4}$ per cent. per annum?

Ans. £514 13*s.* $10\frac{1}{2}$*d.*—6930 *rem.*

(8) Sold goods for £875 5s. 6d., to be paid 5 months hence; what is the present worth, at $4\frac{1}{2}$ per cent. per annum?

Ans. £859 3*s.* $3\frac{3}{4}$*d.*—45 *rem.*

(9) What is the discount of £85 10s., due September 8th, this being July 4th, rebate at 5 per cent. per annum?

Ans. 15*s.* $3\frac{1}{2}$*d.*—62982 *rem.*

(10) What is the present worth of £500, £100 to be paid down, and the rest at two 6 months—that is, £200 at 6 months, and the other £200 at 12 months—at 4 per cent. per annum? *Ans.* £488 7*s.* $8\frac{1}{2}$*d.*

INSURANCE, COMMISSION, AND BROKERAGE,

Are various forms of *per-centage*, and are computed in exactly the same way as interest.

Rule.—Multiply by the rate per cent. and divide by 100.

Note.—When the rate is less than 1 per cent. (as is frequently the case in fire insurance and brokerage), a shorter method is to divide by 100, and take aliquot parts with the rate per cent.

EXAMPLES.—LXVI.

(1) What is the cost of insuring £15,000 on a ship, at $10\frac{1}{4}$ per cent.? *Ans.* £1537 10*s.*

(2) What is the insurance of £2860 on a house and furniture, at 3s. 6d. per cent.? *Ans.* £5 0*s.* $1\frac{1}{5}$*d.*

(3) What is the commission on £287 10s. at $3\frac{1}{2}$ per cent.? *Ans.* £10 1*s.* 3*d.*

(4) If I allow my agent $3\frac{1}{4}$ per cent. for commission, what may he demand on the purchase of goods to the amount of £876 5s. 10d.? *Ans.* £32 17*s.* $2\frac{5}{8}$*d.*

(5) What is the brokerage on £796 14*s.* 7*d.* at 6s. per cent.? *Ans.* £2 7*s.* $9\frac{1}{2}$*d.*

(6) What is the brokerage on £2575 17s. 6d. at $\frac{1}{8}$ per cent.? *Ans.* £3 4*s.* $4\frac{3}{4}$*d.*

STOCKS.

QUESTIONS under this head arise from transactions in the Funds and other Government securities, in the shares of railways and other public companies, and generally in the various descriptions of property known as Stocks. When these are bought or sold, a certain sum of money (*sterling*) is paid for a certain amount of *stock*, according to the state of the money-market for the time being, or according to the market price of the particular description of stock. Thus, when the $3\frac{1}{2}$ per cents. are said to be at 87, it means that £100 in the $3\frac{1}{2}$ per cent. stock can be bought for £87 sterling. Questions in the Purchase and Sale of Stock are worked by the Rule of Three; two out of the four terms of the proportion being the original or *par* value of the stock (usually £100), and its present market price in sterling.

RULE.—Consider whether the answer is to be *stock* or *sterling;* if it is to be *stock*, put the given stock in the third term, the sterling value of it in the first term, and the sterling value of the answer in the second term; if it is to be sterling, put the given sterling in the third term, the corresponding stock in the first term, and the remaining stock in the second term.

NOTE.—1. When the price of stock is simply specified (as 87, in the

instance above), it is always supposed to correspond to an imaginary £100 stock; and these two quantities are to be used accordingly, in the working, as given sterling and stock. 2. When the income derived from stock is involved in the question, it is computed by simple interest at the given rate on the given *stock*.

EXAMPLES.—LXVII.

(1) How much must be given for £254 17s. in the 4 per cents. at $97\frac{1}{4}$? *Ans.* £247 16*s.* $9\frac{99}{100}d.$

(2) When India Stock is at $124\frac{5}{8}$, what is the price of £758 17s. 10d. therein? *Ans.* £945 15*s.* $4\frac{399}{400}d.$

(3) What is the price of the 4 per cents. when I have to give £821 5s. for £1000 stock? *Ans.* $82\frac{1}{8}$

(4) I possess £1000 in the 4 per cents.; I sell out at $92\frac{1}{2}$, and invest the money in the $3\frac{1}{2}$ per cents. at 80; what is the difference in my income? *Ans.* 9*s.* $4\frac{1}{2}d.$

(5) I invest £5500 in the 3 per cents. at $79\frac{1}{2}$, and sell out when they have risen to 81; how much do I gain by the transaction? *Ans.* £103 15*s.* $5\frac{35}{53}d.$

EQUATION OF PAYMENTS

Shows how, when several sums are due at different times, to find a mean time for paying the whole debt.

Rule.—Multiply each payment by its time, and divide the sum of the products by the debt; the quotient is the mean time.

EXAMPLES.—LXVIII.

(1) A owes B £200, whereof £40 is to be paid at 3 months, £60 at 5 months, and £100 at 10 months; at what time may the whole debt be paid together, without prejudice to either?

£		*m.*		£
40	×	3	=	120
60	×	5	=	300
100	×	10	=	1000
				2|00)14|20

Ans. 7 *months*, 3 *days*

(2) B owes C £800, whereof £200 is to be paid at 3 months, £100 at 4 months, £300 at 5 months, and £200 at 6 months; at what time could one payment of the whole be equitably effected? *Ans.* 4 *months*, 18 *days*

(3) A merchant bought goods to the value of £500, to pay £100 at 3 months, £150 at 6 months, and £250 at 12 months; but afterwards they agree to discharge the debt at one payment; at what time was this payment made?

Ans. 8 *months*, 12 *days*

(4) A is indebted to B £600, which is to be paid at six different payments—that is, one-fourth at 2 months, one-eighth at 3 months, one-eighth at 4 months, one-fourth at 5 months, one-eighth at 6 months, and the rest at 7 months; but they agree that the whole shall be paid at one equated time; what is that time? *Ans.* $4\frac{1}{4}$ *months*

Thirty days are reckoned a month in working the above questions.

BARTER

Is the exchanging one commodity for another, and informs traders so to proportion their goods that neither may sustain loss.

Rule 1.—Find the value of that commodity whose quantity is given; then find what quantity of the other, at the rate proposed, you may have for the same money.

2. When one has goods at a certain price for ready money, but in bartering advances it; find what the other ought to rate his goods at, in proportion to that advance, and proceed as before.

EXAMPLES.—LXIX.

(1) What quantity of coffee at 1s. 6d. per lb. must be delivered in barter for 2 cwt. of tea at 4s. per lb.?

Value of tea delivered $= 2 \times 112 \times 4$s.
$= 896$s.

Ans. $896 \div 1\frac{1}{2} = 597\frac{1}{3}$ *lbs.* $= 5$ *cwt.* $37\frac{1}{3}$ *lbs.*

(2) If B has cotton at 2s. 4d. per lb., how much must he give A for 114 lb. of tobacco at $11\frac{1}{2}$d. per lb.?

Ans. $46\frac{92}{115}$ *lb.*

(3) A and B barter; A has $3\frac{1}{2}$ lb. of pepper, at $13\frac{1}{2}$d. per lb.; B has ginger, at $15\frac{1}{4}$d. per lb.; how much ginger must he deliver in barter for the pepper? *Ans.* 3 *lb.* $1\frac{35}{61}$ *oz.*

(4) Two merchants barter; A has 20 cwt. of cheese, at 31s. 6d. per cwt.; B has eight pieces of Irish cloth, at £6 18s. per piece; which must receive the difference, and how much? *Ans. B must receive* £23 14*s*

(5) C has nutmegs worth 8s. 6d. per lb. ready money, but in barter will have 10s.; D has tobacco worth 9d. per lb. ready money; how must he rate it at per lb. that his profit may be equivalent; and what quantity of nutmegs must be delivered for 12 cwt. 1 qr. 18 lb. of tobacco?

Ans. D must advance his tobacco to $10\frac{1}{2}$*d.* $\frac{36}{102}$ *per lb., and he will receive* 1 *cwt.* $9\frac{30}{48}$ *lb. of nutmegs in return for the tobacco.*

PROFIT AND LOSS

Shows what is gained or lost in the purchase or sale of goods, and how to raise or lower the price of them, so as to gain or lose either so much per cent. or so much on a given quantity.

EXAMPLES.—LXX.

(1) If a parcel of cloth sold for £560, and at £12 per cent. gain, what was the prime cost? *Ans.* £500

If £112 : £560 : : £100

100

——— £

112)56000(500 *Ans.*

56000

(2) Bought 436 yards of cloth, at the rate of 8s. 6d. per yard, and sold it for 10s. 4d. per yard; what was the gain on the whole? *Ans.* £39 19*s.* 4*d.*

(3) If 1 lb. of tobacco cost 16d., and is sold for 20d., what is the gain per cent.? *Ans.* £25

(4) If a yard of cloth be bought for 11s. and sold for 12s. 6d., what is the gain per cent.? *Ans.* £13 12*s.* $8\frac{1}{2}$*d.*—10

(5) If a yard of cloth be bought for 13s. 4d., and sold again for 16s., what is the gain per cent.? *Ans.* £20

(6) Sold 1 cwt. of hops for £6 15s., at the rate of £25 per cent. profit; what would have been the gain per cent. if I had sold them for £8 per cwt.? *Ans.* £4 8 *s.* 11½*d.*—30

(7) If 112 lb. of iron cost 27s. 6d., what must 1 cwt. be sold for to gain £15 per cent.? *Ans.* £1 11 *s.* 7½ *d.*

(8) Paid £69 for 1 ton of steel, which is retailed at 6d. per lb.; what is the profit or loss by the sale of 14 tons?

Ans. £182 *loss*

(9) If 375 yards of broad cloth be sold for £490, and 20 per cent. profit, what did it cost per yard?

Ans. £1 1 *s.* 9¼*d.*—125

(10) Bought 249 yards of cloth at 3s. 4d. per yard; retailed the same at 4s. 2d. per yard; what is the profit in the whole, and how much per cent.?

Ans. £10 7 *s.* 6 *d. profit, and* £25 *per cent.*

FELLOWSHIP

Is when two or more join their stocks and trade together, so to determine each person's particular share of the gain or loss, in proportion to his principal in the joint stock.

By this rule a bankrupt's estate may be divided amongst his creditors; as also legacies adjusted, when there is a deficiency of assets or effects.

Fellowship is either with or without Time.

FELLOWSHIP WITHOUT TIME

s when individuals engage in partnership for a particular adventure or business, without regard to time; the profits arising therefrom to be divided among them in proportion to their respective contributions.

Rule.—As the whole stock is to each man's share in stock, so is the whole gain or loss to that man's share of the gain or loss.

Proof.—Add all the shares together, and the sum will be equal to the given gain or loss.

EXAMPLES.—LXXI.

(1) Two merchants traded together; A put into stock £20, and B £40; they gained £50; what was each person's share thereof?

£	£	£	£	*s.*	*d.*	
A 20	As 60 :	20 : :	50 :	16	13	4 = A's share
B 40	As 60 :	40 : :	50 :	33	6	8 = B's share
60				50	0	0 Proof

(2) Three merchants traded together; A put in £20, B £30, and C £40; they gained £180; what is each man's part of the gain? *Ans. A's* £40, *B's* £60, *C's* £80

(3) D, E, and F join stocks in trade; the amount of their stock was £100; D's gain £3, E's £5, and F's £8; what is each man's stock?

Ans. D's stock £18 15*s.*; *E's* £31 5*s.*; *and F's* £50

(4) Three persons, D, E, and F, joined in company; D's stock was £750, E's £460, and F's £500, and at the end of 12 months they gained £684; what is each man's particular share of the gain?

Ans. D's £300; *E's* £184; *and F's* £200

(5) Four persons trading together in a joint stock of £120, of which A has $\frac{1}{3}$, B $\frac{1}{4}$, C $\frac{1}{5}$, and D the remainder, and at the end of 6 months they gain £100; what is each man's share of the said gain?

Ans. A's £33 6*s.* 8*d.*, *B's* £25, *C's* £20, *and D's* £21 13*s.* 4*d.*

(6) A merchant is indebted to B £275 14*s.*; to C £304 7*s.*; to D £152; and to E £104 6*s.*; but upon his decease, his estate is found to be worth but £675 15*s.*; how must it be divided among his creditors?

Ans. B's £222 15*s.* 2*d.*—6584; *C's* £245 18*s.* 1$\frac{1}{2}$*d.*—15750; *D's* £122 16*s.* 2$\frac{3}{4}$*d.*—12227; *and E's* £84 5*s.* 5*d.*—15620.

(7) Two persons purchased an estate of £1700 per annum freehold, for £27200, whereof D paid £15000, and E the rest; some time after they sell the said estate for 24 years' purchase; I desire to know each person's share.

Ans. D's £22500, *E's* £18300

FELLOWSHIP WITH TIME

Is when the shares are to be apportioned not only according to each man's stock or interest in the transaction, but also according to the length of time that interest has been in action.

Rule.—As the sum of the products of each man's money and time is to each such product singly, so is the whole gain or loss to the share corresponding to that product.

Proof.—As in Fellowship without Time.

EXAMPLES.—LXXII.

(1) D and E entered into partnership; D put in £40 for 3 months, and E £75 for 4 months, and they gained £70; what is each man's share of the gain?

£		£
$40 \times 3 = 120$	As 420 : 120 : : 70 : 20 = D's share	
$75 \times 4 = 300$	As 420 : 300 : : 70 : 50 = E's share	
420		70 Proof

(2) D, E, and F held a piece of ground in common, for which they are to pay £36 10s. 6d.; D put in 23 oxen 27 days; E 21 oxen 35 days; and F 16 oxen 23 days; what is each man to pay of the said rent?

Ans. D £13 3*s.* 1½*d.*—624; *E* £15 11*s.* 5*d.*—1688; *and F* £7 15*s.* 11*d.*—1136

(3) Three merchants joined in company; D put into stock £195 14s. for 3 months, E £169 18s. 3d. for 5 months; and F £59 14s. 10d. for 11 months; they gained £364 18s.; what was each man's share of the gain?

Ans. D's £102 6*s.* 4*d.*—5008; *E's* £148 1*s.* 1½*d.*—482802; *and F's* £114 10*s.* 6¼*d.*—14707

(4) Three merchants formed a common stock of £2000; A's gain was £200 in 8 months; B's £168 in 12 months, and C's £240 in 6 months; what ought each to have contributed towards stock?

Ans. A £632 18*s.* 2½*d.*—4736; *B* £797 9*s.* 4¼*d.*—3136; *and C* £569 12*s.* 4¾*d.*—2240

(5) Two partners in 10 months gained £800; A put in at first £200, and at the end of 4 months £300 more. B put in at first £300, and at the end of 2 months £200 more; how must the gain be divided?

Ans. A's share £361 18*s.* $1\frac{1}{7}$*d.*; *B's* £438 1*s.* $10\frac{6}{7}$*d.*

(6) Three merchants enter into partnership for 16 months; A puts into stock at first £100, but at 8 months takes out £40, and at 4 months after that puts in £140; B puts in at first £200, at 6 months 50 more, and at 4 months after that takes out £100; C puts in at first £150, at the expiration of 4 months takes out £50, and at 8 months after that puts in £100; their gain at the expiration of the 16 months amounted to £357; what is each man's share thereof?

£	£	£
A $100 \times 8 = 800$	B $200 \times 6 = 1200$	C $150 \times 4 = 600$
$60 \times 4 = 240$	$250 \times 4 = 1000$	$100 \times 8 = 800$
$200 \times 4 = 800$	$150 \times 6 = 900$	$200 \times 4 = 800$
1840	3100	2200

		£	£
1840	As 7140 : 1840 :: 357 :		92 A's gain.
3100	As 7140 : 3100 :: 357 :		155 B's gain.
2200	As 7140 : 2200 :: 357 :		110 C's gain.
7140			357 Proof.

(7) Three merchants joined in company for 18 months; D put in £500, and at 5 months' end took out £200; at 10 months' end put in £300, and at the end of 14 months took out £130. E put in £400, and at the end of 3 months £270 more; at 9 months he took out £140, but put in £100 at the end of 12 months, and withdrew £99 at the end of 15 months. F puts in £900, and at 6 months took out £200; at the end of 11 months put in £500, but takes out that and £100 more at the end of 13 months; they gained £200. I desire to know each man's share of the gain.

Ans. D's £50 7*s.* 6*d.*—21720; *E's* £62 12*s.* $5\frac{1}{4}$*d.*—29859; *and F's* £87 0*s.* $0\frac{1}{4}$*d.*—14167

FOREIGN EXCHANGES

Are transfers from the money of one country to that of another, usually by means of bills of exchange, which are written orders to pay a certain amount.

The *rate* or *course of exchange* is the variable price of a fixed sum of money of the currency of one country in the money of another country. The country whose money is the fixed integer is said to *receive* the variable price, and the other country is said to *give* it. Thus London *receives* from Amsterdam 12 florins, 3 stivers for £1 sterling, and *gives* St. Petersburg 3s. $2\frac{1}{4}$d. for 1 silver rouble.

English money is called sterling.

The *par of exchange* is the intrinsic value of the coin of one country compared with that of another. It is theoretically, and for most practical purposes actually, fixed. But it is affected by the fact that the standards of value are different in different countries; gold being the standard in England, whilst in many countries it bears a fluctuating premium, or *Agio*.

An Agio has to be allowed also in those countries where the currency is *debased—i.e.*, where it cannot realize its nominal value. This is especially the case with the *paper currency* of many foreign countries.

A General Rule for changing Foreign Money into Sterling.

As the foreign money in the rate of exchange is to the foreign money given, so is the sterling in the rate of exchange to the sterling required.

To change Sterling into Foreign Money.

As the sterling in the rate of exchange is to the sterling given, so is the foreign money in the rate of exchange to the foreign money required.

France.

In France accounts are kept in francs and centimes, (the ancient money—in livres, sous, and deniers—has ceased to

have currency since October, 1834), the par of exchange being 25 francs, 22 centimes for £1.

100 centimes = 1 franc.

EXAMPLES.—LXXIII.

(1) In 7300 francs 30 cents., how much sterling, exchange at 25 francs 16 cents.? *Ans.* £290 3*s.* 3*d.*—276 *rem.*

(2) In £586 10*s.* 6*d.* how many francs, exchange at 25 francs 15 cents.? *Ans.* 14751 *francs*, 10 *cents.*—9 *rem.*

(3) Exchange 5000 francs into sterling, at 25 francs 45 cents. *Ans.* £196 9*s.* $3\frac{1}{2}d.$

NOTE.—The Belgian and Swiss money, weights, and measures are assimilated to the French.

HOLLAND.

At Amsterdam, Rotterdam, &c., accounts are kept in florins or guilders, stivers, and cents., the par of exchange being 11 florins 97 cents. for £1.

100 cents. *or* 20 stivers = 1 florin or guilder.
50 stivers *or* $2\frac{1}{2}$ florins = 1 rix-dollar.

(4) Exchange £1729 14s. 8d. sterling into florins, at 12 florins $7\frac{1}{2}$ cents. to the pound. *Ans.* 20886 *florins*, 52 *cents.*

(5) In 12112 florins, 50 cents., how much sterling, at 12 florins $11\frac{1}{4}$ cents. to the pound. *Ans.* £1000

HAMBURG.

At Hamburg, Altona, &c., accounts are kept in marks, schillings, and pfennings. There are two sets of money, Banco and Currency; the agio varies from 20 to 25 per cent. calculated on the Banco; and is therefore (at 25 per cent.) $\frac{1}{4}$ of the Banco, or $\frac{1}{5}$ of the Currency.

12 pfennings = 1 schilling.
16 schillings = 1 mark.
3 marks = 1 rix-dollar.

The par of exchange is, for Banco, about 13 marks $10\frac{1}{2}$ schillings to the pound; and for currency, about 16 marks 12 schillings.

(6) Exchange £1101 into banco, at 13 marks, 6 schillings to the pound. *Ans.* 14725 *marks*, 14 *sch.*

(7) Exchange 9793 marks, 8 schillings banco into sterling at 13 marks, $10\frac{1}{4}$ schillings. *Ans.* £717 19*s.* 4*d.*

Russia.

At St. Petersburg accounts are kept in roubles and copeks, metallic and paper. The par of exchange is, for the metallic currency, about 3s. $1\frac{1}{2}$d. per silver rouble; and, for the paper currency, about $10\frac{5}{7}$d. per rouble banco.

100 Copeks = 1 Silver Rouble.

(8) Convert £2000 sterling into silver roubles, exchange at 3s. $1\frac{1}{4}$d. per silver rouble. *Ans.* 12885 *silver roubles*, 90 *copeks*

(9) Convert 9753 silver roubles, 12 copeks into sterling, at 3s. $1\frac{15}{16}$d. *Ans.* £1541 14*s.* 0*d.*

Prussia.

At Berlin accounts are kept in Prussian dollars or thalers, and silver groschen: 6 Prussian dollars 27 silver groschen about = £1 at par.

30 silver groschen = 1 Prussian dollar.

(10) Convert £250 into Prussian money, exchange at 6 Prussian dollars $28\frac{1}{2}$ silver groschen to the pound.

Ans. 1737 *Prussian dollars*, 15 *silver groschen*

(11) Convert 4000 Prussian dollars into sterling, exchange at 6 Prussian dollars $27\frac{1}{2}$ silver groschen to the pound.

Ans. £578 6*s.* 3*d.*

Portugal.

At Lisbon and Oporto accounts are kept in reis and milreis, one milreis being about 4s. 6d. at par.

1000 reis = 1 milreis.
1000 milreis = 1 conto of reis.

(12) Convert £500 into reis, at 4s. 9d. to the milreis.

Ans. reis 2,105,263

(13) Convert reis 5,000,000 into sterling, at 4s. $9\frac{1}{2}$d.

Ans. £1197 18*s.* 4*d.*

MISCELLANEOUS.

NOTE.—The pars of exchange are, in many cases, approximations only.

SPAIN.

34 maravedis = 1 real.
20 reales = 1 hard dollar.
Par, 4s. 2d. = 1 „ „

AUSTRIA.

100 kreuzer = 1 florin or gulden.
Par, 131 flor. 80 kr. = £10.

THE ZOLLVEREIN STATES.

South Germany—60 kreuzers = 1 florin or gulden.
Par, 120$\frac{1}{2}\frac{1}{5}$ florins = £10.

North Germany—30 North German thalers = 52$\frac{1}{2}$ South German florins.

DENMARK.

96 skilling = 1 Rigsbank daler.
Par, 9 Rigsbank dalers = £1.

NORWAY.

120 skilling = 1 specie daler.
Par, 4 specie daler 33 sk. = £1.

SWEDEN.

12 runstyken = 1 skilling.
48 skillingar = 1 daler.
Par, 12 d. 1 sk. 11 r. (Banco), = £1.

KINGDOM OF ITALY.

100 centesimi = 1 lira.
Par, about 25 lire = £1.

ROME.

100 bajocchi, or 10 paoli = 1 scudo Romano.
Par, about 46 paoli = £1.

TURKEY.

40 paras = 1 piastre.
100 piastres = 1 medjidie.
Par, 150 piastres = £1.

GREECE.

100 lepta = 1 drachma.
Par, $28\frac{3}{10}$ drachmai = £1.

THE UNITED STATES.

100 cents = 1 dollar ($).
Par, $1 = 4s. 2d.

EAST INDIES.

Calcutta and Madras—12 pice = 1 anna.
16 annas = 1 rupee.
Bombay—100 reas = 1 quarter.
4 quarters = 1 rupee.
Par, 1 rupee = 2s.

CONJOINED PROPORTION

Is employed when the coin, weights, or measures of several countries are compared in the same question; or it is linking together a variety of proportions.

When it is required to find how many of the first sort of coin, weight, or measure, mentioned in the question, are equal to a given quantity of the last,

RULE.—Place the numbers alternately, beginning at the left hand, and let the last number stand on the left hand; then multiply the first row continually for a dividend, and the second for a divisor.

PROOF.—By as many Single Rules of Three as the question requires.

EXAMPLES.—LXXIV.

(1) If 20 lb. at London make 23 lb. at Antwerp, and 155 lb. at Antwerp make 180 lb. at Leghorn, how many lb. at London are equal to 72 lb. at Leghorn?

Left.	*Right.*	
20	23	$20 \times 155 \times 72 = 223200$
155	180	$23 \times 180 = 4140)223200(53\frac{3}{4}\frac{7}{1}\frac{3}{4}$
72		

(2) If 12 lb. at London make 10 lb. at Amsterdam, 100 lb. at Amsterdam 120 lb. at Toulouse, how many lb. at London are equal to 40 lb. at Toulouse? *Ans.* 40 *lb.*

(3) If 140 braces at Venice are equal to 156 braces at Leghorn, and 7 braces at Leghorn equal to 4 ells English, how many braces at Venice are equal to 16 ells English?

Ans. $25\frac{5}{3\,9}$

When it is required to find how much of the last sort of coin, weight, or measure, mentioned in the question, is equal to the quantity of the first,

RULE.—Place the numbers alternately, beginning at the left hand, and let the last number stand on the right hand; then multiply the first row for a divisor, and the second for a dividend.

(4) If 12 lb. at London make 10 lb. at Amsterdam, 100 lb. at Amsterdam 120 lb. at Toulouse, how many lb. at Toulouse are equal to 40 lb. at London? *Ans.* 40 *lb.*

(5) If 40 lb. at London make 36 lb. at Amsterdam, and 90 lb. at Amsterdam 116 lb. at Dantzic, how many lb. at Dantzic are equal to 122 lb. at London? *Ans.* $141\frac{3}{2\,5}$

SQUARE ROOT.

EXTRACTING the Square Root is the finding a number such that, when multiplied into itself, the product is the given number.

RULE.—First, point the given number, by placing a dot

over the figure in the unit's place, then the hundreds, and so upon every second figure throughout.

Secondly, Find the greatest square number in the first point towards the left hand, placing the square number under the first point, and the root thereof in the quotient; subtract the square number from the first point, and to the remainder bring down the next point, and call that the resolvend.

Thirdly, Double the quotient, and place it for a divisor on the left hand of the resolvend; find how often the divisor is contained in the resolvend (preserving always the unit's place), and put the answer in the quotient, and also on the right-hand side of the divisor; then multiply by the figure last put in the quotient, and subtract the product from the resolvend; bring down the next point to the remainder (if there be any), and proceed as before.

When the given number consists of a whole number and decimals together, if the decimals are odd, make them even by adding a cipher to them, as there must be a point on the unit's place of the whole number.

PROOF.—Square the quotient, and add thereto the remainder, as in common division.

Roots.	1	2	3	4	5	6	7	8	9
Squares.	1	4	9	16	25	36	49	64	81

EXAMPLES.—LXXV.

(1) What is the square root of 119025?

1̇1̇9̇0̇2̇5̇ (345		*Ans.*	345
9			345
64)290			1725
256			1380
685)3425			1035
3425			119025 *Proof*

(2) What is the square root of 106929? *Ans.* 327
(3) What is the square root of 36372961? *Ans.* 6031
(4) What is the square root of 22071204? *Ans.* 4698

To extract the Square Root of a Vulgar Fraction.

RULE.—Reduce the fraction to its lowest terms, then extract the square root of the numerator for a new numerator, and the square root of the denominator for a new denominator.

If the fraction be a SURD—that is, a number where a root cannot be exactly found—reduce it to a decimal, and extract the root of it.

EXAMPLES.—LXXVI.

(1) What is the square root of $\frac{2704}{4225}$? *Ans.* $\frac{4}{5}$
(2) What is the square root of $\frac{92161}{125544}$? *Ans.* $\frac{6}{7}$

SURDS.

(3) What is the square root of $\frac{2757}{3141}$? *Ans.* ·89802 +
(4) What is the square root of $\frac{2577}{4776}$? *Ans.* ·86602 +

To extract the Square Root of a Mixed Number.

RULE.—1. Reduce the fractional part of the mixed number to its lowest terms, and then the mixed number to an improper fraction.

2. Extract the root of the numerator and of the denominator for a new numerator and denominator.

If the mixed number given be a surd, reduce the fractional part to a decimal, annex it to the whole number, and extract the square root thereof.

EXAMPLES.—LXXVII.

(1) What is the square root of $27\frac{9}{16}$? *Ans.* $5\frac{1}{4}$
(2) What is the square root of $9\frac{43}{49}$? *Ans.* $3\frac{1}{7}$

SURDS.

(3) What is the square root of $8\frac{5}{7}$? *Ans.* 2·9519 +
(4) What is the square root of $6\frac{2}{3}$? *Ans.* 2·5819 +

THE APPLICATION OF SQUARE ROOT.

To find the Side of a Square that is equal in Area to any given Superficies.

RULE.—The square root of the content of any given superficies is the side of a square of equal content.

EXAMPLES.—LXXVIII.

(1) If the content of a given circle be 160, what is the side of the square equal to it? *Ans.* 12·64911 +

(2) If the area of a circle be 750, what is the side of the square equal thereto? *Ans.* 27·38612 +

The Area of a Circle given to find the Diameter.

RULE.—Multiply the square root of the area by 1·12837, and the product will be the diameter.

(3) What length of cord should be tied to a cow's leg, the other end fixed in the ground, to let her have liberty of eating an acre of grass, and no more, the length of the cow with her leg extended being $5\frac{1}{2}$ yards? *Ans.* 6·136 *perches*

The Area of a Circle given to find the Circumference.

RULE.—Multiply the square root of the area by 3·5449, and the product is the circumference.

(4) When the area is 12, what is the circumference?
Ans. 12·2799 *and* 49599 *rem.*

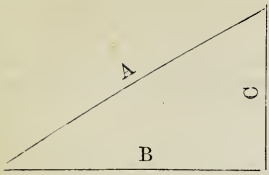
(5) When the area is 160, what is the periphery?
Ans. 44·839 *and* 83279 *rem.*

SOLUTION OF TRIANGLES.

The Base and Perpendicular given to find the Hypothenuse.

RULE.—The square root of the sum of the squares of the base and perpendicular is the length of the hypothenuse.

(6) The top of a castle from the ground is 45 yards high, and surrounded with a ditch 60 yards broad; what length must a ladder be to reach from the outside of the ditch to the top of the castle? *Ans.* 75 *yards*



A. Length of the ladder or hypothenuse.
B. Base or ditch, 60 yards.
C. Perpendicular or height, 45 yards.

(7) The wall of a town is 25 feet high, which is surrounded by a moat of 30 feet in breadth: I desire to know the length of a ladder that will reach from the outside of the moat to the top of the wall. *Ans.* 29·05 *feet, and* 975 *rem.*

The Hypothenuse and Perpendicular given to find the Base.

Rule.—The square root of the difference of the squares of the hypothenuse and perpendicular is the length of the base.

(8) There is a tower of 103 feet in height, standing close to a river, and a string of 320 feet long, fastened at the top of it, will reach to the opposite side: what width is the river?
Ans. 302·97 *feet, and* 1791 *rem.*

The Base and Hypothenuse given to find the Perpendicular.

Rule.—The square root of the difference of the squares of the hypothenuse and base is the height of the perpendicular.

(9) A ladder 40 feet long is so planted in a street that it will reach a window 33 feet from the ground, and with keeping the foot of it in the same place, it will reach a window on the opposite side 21 feet high; the breadth of the street is required.
Ans. 56·64 *feet*

CUBE ROOT.

To extract the Cube Root is to find a number which, being multiplied into itself, and then into that product, will produce the given number.

Rule.—1. Point every third figure of the number given, beginning at the unit's place; seek the greatest cube to the first point, and subtract it therefrom; put the root in the

quotient, and bring down the figures in the next point to the remainder for a RESOLVEND.

2. Find a DIVISOR by multiplying the square of the quotient by 3. See how often it is contained in the resolvend, rejecting the units and tens, and put the number of times in the quotient.

3. To find the SUBTRAHEND. 1. Cube the last figure in the quotient. 2. Multiply all the figures in the quotient by 3, except the last, and that product by the square of the last. 3. Multiply the divisor by the last figure. Add these products together, taking care to place the unit's figure of the second product under the ten's figure of the first product, and the unit's figure of the third product under the ten's figure of the second. Subtract the sum from the resolvend; to the remainder bring down the next point, and proceed as before.

PROOF. — Cube the quotient, and add thereto the remainder.

Roots.	1.	2.	3.	4.	5.	6.	7.	8.	9.
Cubes.	1.	8.	27.	64.	125.	216.	343.	512.	729.

EXAMPLES.—LXXIX.

(1) What is the cube root of 99252847?

99252847 (463
64 = *cube of* 4
Divisor———
Square of 4 × 3 = 48)35252 *resolvend.*

216 = *cube of* 6.
432 = 4 × 3 × *by square of* 6.
288 = *divisor* × *by* 6.

33336 *subtrahend.*

Divisor———
Square of 46 × 3 = 6348) 1916847 *resolvend.*

27 = *cube of* 3
1242 = 46 × 3 × *by square of* 3.
19044 = *divisor* × *by* 3.

1916847 *subtrahend.*

(2) What is the cube root of 389017? *Ans.* 73
(3) What is the cube root of 5735339? *Ans.* 179
(4) What is the cube root of 32461759? *Ans.* 319
(5) What is the cube root of 84604519? *Ans.* 439
(6) What is the cube root of 259694072? *Ans.* 638

When the given number consists of a whole number and decimal figures, make the number of decimals to consist of 3, 6, 9, &c., places by adding ciphers thereto, as a point must be on the unit's place of the whole number.

(7) What is the cube root of 12·977875? *Ans.* 2·35
(8) What is the cube root of ·001906624? *Ans.* ·124

To extract the Cube Root of a Vulgar Fraction.

RULE.—Reduce the fraction to its lowest terms, then extract the cube root of the numerator and the denominator for a new numerator and denominator; but if the fraction be a surd, reduce it to a decimal, and extract the root thereof.

(9) What is the cube root of $\frac{250}{686}$? *Ans.* $\frac{5}{7}$
(10) What is the cube root of $\frac{324}{1500}$? *Ans.* $\frac{3}{5}$

SURDS.

(11) What is the cube root of $\frac{4}{7}$? *Ans.* ·829 +
(12) What is the cube root of $\frac{5}{9}$? *Ans.* ·822 +

To extract the Cube Root of a mixed Number.

RULE.—Reduce the fractional part to its lowest terms, and then the mixed number to an improper fraction; extract the cube root of the numerator and the denominator for a new numerator and denominator; but if the mixed number given be a surd, reduce the fractional part to a decimal, annex it to the whole number, and extract the cube root thereof.

(13) What is the cube root of $12\frac{19}{27}$? *Ans.* $2\frac{1}{3}$
(14) What is the cube root of $8\frac{5}{7}$? *Ans.* 2·057 +

THE APPLICATION OF CUBE ROOT.

EXAMPLES.—LXXX.

(1) If a cubical piece of timber be 47 inches long, 47 inches broad, and 47 inches deep, how many cubical inches does it contain? *Ans.* 103823

(2) There is a stone of cubic form which contains 389017 solid feet; what is the superficial content of one of its sides? *Ans.* 5329

To find the Side of a Cube that shall be equal in Solidity to any given Solid, as a Globe, Cylinder, Prism, Cone, &c.

RULE.—The cube root of the solid content of any solid body given is the side of the cube with equal solidity.

(3) If the solid content of a globe be 10648, what is the side of a cube of equal solidity? *Ans.* 22

The Side of the Cube being given, to find the Side of the Cube that shall be double, treble, &c., in Quantity to the Cube given.

RULE.—Cube the side given, and multiply it by 2, 3, &c.; the cube root of the product is the side sought.

(4) There is a cubical vessel whose side is 12 inches, and it is required to find the side of another vessel that is to contain three times as much. *Ans.* 17·306

EXTRACTING OF THE BIQUADRATE ROOT.

To extract the Biquadrate Root is to find a number which, being involved four times into itself, will produce the given number.

RULE.—First extract the square root of the given number, and then extract the square root of that square root, and it will give the biquadrate root required.

EXAMPLES.—LXXXI.

(1) What is the biquadrate of 27? *Ans.* 531441

(2) What is the biquadrate of 76? *Ans.* 33362176

(3) What is the biquadrate root of 531441? *Ans.* 27

(4) What is the biquadrate root of 33362176? *Ans.* 76

A GENERAL RULE FOR EXTRACTING THE ROOTS OF ALL POWERS.

1. Prepare the number given for extraction by pointing off from the unit's place as the root required directs.

2. Find the first figure in the root, which subtract from the given number.

3. Bring down the first figure in the next point to the remainder, and call it the dividend.

4. Involve the root into the next inferior power to that which is given, multiply it by the given power, and call it the divisor.

5. Find a quotient figure by common division, and annex it to the root; then involve the whole root into the given power, and call that the subtrahend.

6. Subtract that number from as many points of the given power as are brought down, beginning at the lower place, and to the remainder bring down the first figure of the next point for a new dividend.

7. Find a new divisor, and proceed in all respects as before.

EXAMPLE.

What is the biquadrate root of 19987173376?

19987173376(376
81

108)1188 *dividend.*

1874161 *subtrahend.*

202612)1245563 *dividend.*

19987173376 *subtrahend.*

$3 \times 3 \times 3 \times 4 = 108$ *divisor.*

$37 \times 37 \times 37 \times 37 = 1874161$ *subtrahend.*

$37 \times 37 \times 37 \times 4 = 202612$ *divisor.*

$376 \times 376 \times 376 \times 376 = 19987173376$ *subtrahend.*

PROOF.—Multiply the root into itself as many times as the given power prescribes.

DUODECIMALS.

Commonly termed Cross Multiplication.

RULE.—For *superficial measure*, multiply the length by the breadth; and that product again by the thickness for *solid measure*.

1. Place under the multiplicand the corresponding denominations of the multiplier.

2. Multiply each term in the multiplicand, beginning with the lowest, by the highest in the multiplier, observing to carry one for every 12 therein contained to the next superior product; put down the remainder under the denomination of the same name.

3. Proceed in like manner with the inches and parts in the multiplier, setting down the remainder, on commencing each line, a place more to the right than the preceding one; thereby forming parts, seconds, thirds, &c.

The last product of the multiplications is the answer.

EXAMPLES.—LXXXII.

F.	In.		F.	In.
Multiply 7.	9	by	3 .	6

7 . 9
3 . 6

23 . 3 × 3
3 . 10.6 × 6

27 . 1.6

	F.	In.		F.	In.	Ft.
(1) Multiply	8.	5	by	4.	7.	*Ans.* 38.6′.11″
(2) Multiply	9.	8	by	7.	6.	*Ans.* 72.6
(3) Multiply	8.	1	by	3.	5.	*Ans.* 27.7′.5″
(4) Multiply	7.	6	by	5.	9.	*Ans.* 43.1′.6″
(5) Multiply	4.	7	by	3.	10.	*Ans.* 17.6′.10″
(6) Multiply	75.	7	by	9.	8.	*Ans.* 730.7′.8″
(7) Multiply	97.	8	by	8.	9.	*Ans.* 854.7′

	Ft. In.	Ft. In.	Ft.
(8) Multiply	57.9 by	9. 5.	*Ans.* 543.9′.9″
(9) Multiply	75.9 by	17. 7.	*Ans.* 1331.11′.3″
(10) Multiply	87.5 by	35. 8.	*Ans.* 3117.10′.4″
(11) Multiply	179.3 by	38. 10.	*Ans.* 6960.10′.6″
(12) Multiply	259.2 by	48. 11.	*Ans.* 12677.6′.10″
(13) Multiply	7.5′.9″ by	3.5′.3″	*Ans.* 25.8′.6″.2‴6⁗
(14) Multiply	10.4′.5″ by	7.8′.6″.	*Ans.* 79.11′.0″.6‴.6⁗
(15) Multiply	257.9 by	39. 11.	*Ans.* 10288.6′.3″
(16) Multiply	311.4′.7″ by	36.7′.5″.	
			Ans. 11402.2′.4″.11‴.11⁗
(17) Multiply	321.7′.3″ by	9.3′.6″.	*Ans.* 2988.2′.10″.4‴.6⁗

ALLIGATION

IS EITHER MEDIAL OR ALTERNATE, PARTIAL OR TOTAL.

ALLIGATION MEDIAL

Is when the quantities and prices of several sorts are given to be mixed, to find the mean price of that mixture.

RULE.—As the whole composition is to the given part, so is the total value to the price of that part.

EXAMPLES.—LXXXIII.

(1) A farmer mixed 20 bushels of corn at 5s. per bushel, and 36 bushels at 3s. per bushel, with 40 bushels at 2s. per bushel. I desire to know the worth of a bushel of this mixture.

$20 \times 5 = 100$
$36 \times 3 = 108$
$40 \times 2 = 80$

96 288

b. b. s. s.
As 96 : 1 :: 288 : 3

Ans. 3*s.*

(2) A grocer mixed 4 cwt. of sugar at 56s. per cwt., 7 cwt. at 43s. per cwt., and 5 cwt. at 37s. per cwt.; I demand the price of 2 cwt. of this mixture. *Ans.* £4 8*s.* 9*d.*

(3) A maltster mixed 30 quarters of brown malt, at 28s. per quarter, with 46 quarters of pale, at 30s. per quarter, and 24 quarters of high-dried ditto, at 25s. per quarter; what is the value of 8 bushels of this mixture? *Ans.* £1 8*s.* $2\frac{1}{4}\frac{6}{10}$*d.*

ALLIGATION ALTERNATE

Is when the prices of several sorts are given to find such quantities of them to make a mixture, that may bear a price propounded.

In ordering the Rates and the given Price,

Rule 1.—Place them one under the other, and the propounded price or mean rate at the left hand of them; thus:

22 { 18— 2 ; 20— 6 ; 24— 4 ; 28— 2 }

2. Link the several rates, always observing to join a greater and a less than the mean price.

3. Against each extreme place the difference of the mean and the one it is linked to.

When the prices of the several sorts and the mean rate are given without any quantity, to find how much of each sort is required to compose the mixture.

Rule.—Take the difference between each price and the mean rate, and set them alternately; they will be the answer required.

EXAMPLES.—LXXXIV.

(1) A wine merchant would mix four sorts of wine together, of 18d., 20d., 24d., and 28d. per pint; what quantity of each must he take to sell the mixture at 22d. per pint?

22 { 18— 2 of 18d. = 36d. ; 20— 6 of 20d. = 120 ; 24— 4 of 24d. = 96 ; 28— 2 of 28d. = 56 }

14)308

22d.

or thus,

22 { 18— 6 of 18d. = 108d. ; 20— 2 of 20d. = 40 ; 24— 2 of 24d. = 48 ; 28— 4 of 28d. = 112 }

14)308

22d.

NOTE.—Questions in this rule admit of a great variety of answers, according to the manner of linking them.

(2) A grocer would mix sugar at 4d., 6d., and 10d. per lb., so as to sell the compound for 8d. per lb.; what quantity of each must he take?

Ans. 2 *lb. at* 4*d.*, 2 *lb. at* 6*d.*, *and* 6 *lb. at* 10*d.*

(3) A farmer would mix barley at 3s. 6d., at 4s., and at 2s. per bushel each, so that the mixture may be at 2s. 6d. per bushel; how much must he take of each sort?

Ans. 6 *bushels at* 3*s.* 6*d.*, 6 *at* 4*s.*, *and* 30 *at* 2*s. per bushel*

(4) A grocer would mix raisins at 7d. per lb. with others at 6d. and at 4d. per lb. I desire to know what quantity of each sort he must take to sell them at 5d. per lb.

Ans. 1 *lb. of raisins at* 7*d. per lb.*, 1 *lb. at* 6*d.*, *and* 3 *lb. at* 4*d. per lb.*

ALLIGATION PARTIAL

Is when the prices of all the sorts, the quantity of but one of them, and the mean rate are given, to find the several quantities of the rest in proportion to that given.

RULE.—Take the difference between each price and the mean rate, as before. Then,

As the difference of that sort, whose quantity is given, is to the rest of the differences severally, so is the quantity given to the several quantities required.

EXAMPLES.—LXXXV.

(1) A tobacconist wishing to mix 20 lb. of tobacco at 15d. per lb. with others at 16d., 18d., and 22d. per lb., how many pounds of each sort must he take to make 1 lb. of that mixture worth 17d.?

17	15	5	20 lb. at 15d. = 300d.	As 5 : 1 :: 20 : 4
	16	1	4 lb. at 16d. = 64d.	As 5 : 1 :: 20 : 4
	18	1	4 lb. at 18d. = 72d.	As 5 : 2 :: 20 : 8
	22	2	8 lb. at 22d. = 176d.	

As 36 lb. : 612d. :: 1 lb. : 17d.

(2) A farmer would mix 20 bushels of wheat at 60d. per bushel with other sorts at 36d., at 24d., and at 18d. per bushel; how much must he take of each to make the composition worth 32d. per bushel?

Ans. 20 *bushels at* 60*d.*, 35 *bushels at* 36*d.*, 70 *bushels at* 24*d.*, *and* 10 *bushels at* 18*d.*

(3) A wine merchant is desirous of mixing 18 gallons of wine at 6s. 9d. per gallon with other sorts at 7s. 6d., at 5s., and at 4s. 3d. per gallon; how much of each sort must he take that the mixture may be sold for 6s. per gallon?

Ans. 18 *gallons at* 6*s.* 9*d. per gallon*, $31\frac{1}{2}$ *at* 7*s.* 6*d.*, $13\frac{1}{2}$ *at* 5*s.*, *and* 27 *at* 4*s.* 3*d. per gallon*

ALLIGATION TOTAL

Is when the price of each sort, the quantities to be compounded, and the mean rate are given, to find how much of each sort will make the quantity.

Rule.—Take the difference between each price and the mean rate, as before. Then,

As the sum of the differences : is to each particular difference : : so is the quantity given : to the quantity required.

EXAMPLES.—LXXXVI.

(1) A grocer has four sorts of sugar, viz., 12d., 10d., 6d., and 4d. per lb., and would make a composition of 144 lb. worth 8d. per lb. I desire to know what quantity of each he must take.

Ans. 48 *lb. at* 12*d.*, 24 *lb. at* 10*d.*, 24 *lb. at* 6*d.*, *and* 48 *lb. at* 4*d.*

8	12	4 .. 48 at 12d.	576	As 12 : 4 :: 144 : 48
	10	2 .. 24 at 10d.	240	As 12 : 2 :: 144 : 24
	6	2 .. 24 at 6d.	144	
	4	4 .. 48 at 4d.	192	
	12	144	)1152(8d.	

(2) A silversmith has four sorts of gold, viz., of 24 carats fine, of 22, 20, and 15 carats fine; he wishes to mix enough of each sort to make 42 oz. of 17 carats fine; how much must he take of each?

Ans. 4 *of* 24, 4 *of* 22, 4 *of* 20, *and* 30 *of* 15 *carats fine*

(3) A druggist having some drugs of 8s., 5s., and 4s. per lb., made them into two parcels; one of 28 lb. at 6s. per lb., the other of 42 lb. at 7s. per lb.; how much of each sort did he take for each parcel?

Ans. 12 *lb.* of 8*s.*
8 *lb.* of 5*s.*
8 *lb.* of 4*s.*
28 *lb.* *at* 6*s.* *per lb.*

Ans. 30 *lb.* of 8*s.*
6 *lb.* of 5*s.*
6 *lb.* of 4*s.*
42 *lb.* *at* 7*s.* *per lb.*

POSITION, OR THE RULE OF FALSE,

Teaches how, by false or supposed numbers, to discover the true one required. It is divided into two parts—Single and Double.

SINGLE POSITION

Is, by using one supposed number, and working with it as the true one, to find the real number required.

Rule.—As the total obtained by working with the supposed number is to the supposed number, so is the true total to the number required.

EXAMPLES.—LXXXVII.

(1) A schoolmaster being asked how many schclars he had, said, If I had twice as many, half as many, and one quarter as many, I should have 88; how many had he? *Ans.* 32

Suppose he had	40	As 110 : 40 :: 88	32
As many more	40	40	32
Half as many ..	20	——	16
¼ as many	10	11,0)352,0(32 *Ans.*	8
	110		88 *proof*

(2) A person having about him a certain number of coins, said, if the third, fourth, and sixth of them were added together, they would make 54. I desire to know how many he had. *Ans.* 72

(3) A, B, and C, being determined to buy a quantity of goods, which would cost them £120, agreed among themselves that B should pay a third part more than A, and C a fourth part more than B. I desire to know what each man must pay. *Ans. A* £30, *B* £40, *and C* £50

(4) A person delivered to another a certain sum of money, to receive interest for the same, at 6 per cent. per annum, simple interest, and at the end of ten years received for principal and interest £300; what was the sum lent?

Ans. £187 10*s.*

DOUBLE POSITION

Uses two false or supposed numbers to find the true one required. Take two numbers, and work with each as if it were the required one. If they both prove wrong (as usually happens), proceed in the following way:—

Rule.—1. Place each error against its respective position.

2. Multiply them crosswise.

3. If the errors are both greater or both less than the given number, take their difference for a divisor, and the difference of their products for a dividend. But if one be greater, and the other less, then take their sum for a divisor, and the sum of their products for a dividend; the quotient will be the answer.

EXAMPLES.—LXXXVIII.

(1) A, B, and C would divide £200 among them, so that B may have £6 more than A, and C £8 more than B. How much must each have?

Suppose A had 40 *Then suppose A had* 50
B had 46 *B must have* 56
and C ... 54 *and C*..... 64

140 *too little by* 60 170 *too little by* 30

sup.ns. errors.

40 × 60
50 × 30

3000	1200	60	60 A
1200		30	66 B } *Ans.*
		—	74 C
3,0)180,0		30 divisor.	200 *proof.*

£60 for A.

(2) A man had 2 silver cups of unequal weight, having one cover to both, of 5 oz.; now if the cover be put on the less cup, it will be double the weight of the greater; and if set on the greater cup, it will be thrice as heavy as the less; what is the weight of each? *Ans.* 3 *oz. less,* 4 *oz. greater*

(3) Three persons discoursing concerning their ages; says H, I am 30 years of age; says K, I am as old as H, and $\frac{1}{4}$ of L; and says L, I am as old as you both; what was the age of each person? *Ans. H* 30, *K* 50, *and L* 80

PROGRESSION

CONSISTS OF TWO PARTS,

ARITHMETICAL AND GEOMETRICAL.

ARITHMETICAL PROGRESSION

Is when a series of numbers increases or decreases regularly by the continual adding or subtracting of equal numbers. As 1, 2, 3, 4, 5, 6, are in Arithmetical Progression by the con-

tinual increasing or adding one; so are 11, 9, 7, 5, 3, 1, by the continual decreasing or subtracting of two.

NOTE.—When any even number of terms are in Arithmetical Progression, the sum of the two extremes will be equal to the two middle numbers, or any two means equally distant from the extremes: as 2, 4, 6, 8, 10, 12; where $6+8=12+2=10+4=14$.

When the number of terms are odd, the double of the *middle term* will be equal to the *two extremes*; or of any *two means* equally distant from the *middle term*; as 1, 2, 3, 4, 5; where the double of $3=5+1=2+4=6$.

In Arithmetical Progression five things are to be observed, viz.—

1. The first term.
2. The last term.
3. The number of terms.
4. The equal difference of the terms.
5. The sum of all the terms.

Any three of which being given, the other two may be found.

The first and last terms and the number of terms given, to find the sum of all the terms.

RULE.—Multiply the sum of the two extremes by half the number of terms; the product is the answer.

EXAMPLES.—LXXXIX.

(1) How many strokes does the hammer of a clock strike in twelve hours?

$12+1=13\times 6=78$ strokes. *Ans.*

(2) A man buys 17 yards of cloth, and gave for the first yard 2s., and for the last 10s.; what did the 17 yards amount to? *Ans.* £5 2*s.*

(3) If 100 eggs were placed in a right line, exactly a yard asunder from one another, and the first a yard from a basket, what length of ground does that man go who gathers up these 100 eggs singly, returning with every egg to the basket to put it in? *Ans.* 5 *miles*, 1300 *yards*

The first and last terms, and the number of terms given, to find the equal difference.

RULE.—From the last term subtract the first; the remainder, divided by the number of terms less 1, will be the equal difference.

(4) A man had eight sons; the youngest was 4 years old, and the eldest 32; they increased in Arithmetical Progression; what was the common difference of their ages?

$32 - 4 = 28 \qquad 8 - 1 = 7 \qquad 28 \div 7 = 4$ *Ans.*

(5) A man is to travel from London to a certain place in 12 days, and to go but 3 miles the first day, increasing every day by an equal excess, so that the last day's journey may be 58 miles; what is the daily increase, and how many miles distant is that place from London?

Ans. 5 *miles daily increase. The whole distance* 366 *miles*

Explanation { *As three miles is the first day's journey,*
$3 + 5 = 8$ *the second day,*
$8 + 5 = 13$ *the third day, &c.*

The first and last terms, and the difference between each term given, to find the number of terms.

RULE.—From the last term subtract the first, divide the remainder by the difference, and to the quotient add 1.

(6) A person travelling into the country went 3 miles the first day, and increased every day 5 miles, till at last he went 58 miles in one day; how many days did he travel?

$58 - 3 = 55 \div 5 = 11 + 1 = 12$ *days. Ans.*

The last term, the number of terms, and difference between each given, to find the first term.

RULE.—Multiply the difference by the number of terms less 1, and subtract the product from the last term.

(7) A man in 10 days went from London to a certain town in the country, every day's journey increasing the

former by 4, and the last he went was 46 miles; what was the first?

4	46
10 less 1 = 9	36
36	*Ans.* 10 *miles.*

(8) A man takes out of his pocket at 8 several times as many different numbers of shillings, every one exceeding the former by 6, the last 46; what was the first? *Ans.* 4

The number of terms, the difference between each, and the sum of all the terms given, to find the first.

Rule.—Divide the sum by the number of terms, and from the quotient subtract half the product of the difference multiplied by the number of terms less 1.

(9) A man is to receive £360 at 12 separate payments, each to exceed the former by £4, and is willing to bestow the first payment on any one that can tell him what it is; how much will the person have for his pains?

12)360	4
	12 less 1 = 11
From 30	
Take 22	2)44
Ans. £8	22

The first term, the number of terms, and the difference between each given, to find the last term.

Rule.—Multiply the number of terms by the difference, from which subtract the said difference, and to the remainder add the first term.

(10) What is the last number of an arithmetical progression, beginning at 6, and continuing by the increase of 8 to 20 places?

$20 \times 8 = 160 - 8 = 152 + 6 = 158$ last term. *Ans.*

GEOMETRICAL PROGRESSION

Is the increasing or decreasing of any rank of numbers by some common ratio; that is, by the continual multiplication or division of some equal number: as 2, 4, 8, 16, increase by the multiplier 2; and 16, 8, 4, 2 decrease, by the divisor 2.

NOTE.—When any number of terms is continued in Geometrical Progression, the product of the two extremes will be equal to any two means, equally distant from the extremes; as 2, 4, 8, 16, 32, 64, where $64 \times 2 = 4 \times 32 = 8 \times 16 = 128$.

When the number of terms are odd, the middle term multiplied into itself will be equal to the two extremes, or any two means, equally distant from the mean; as 2, 4, 8, 16, 32, where $2 \times 32 = 4 \times 16 = 8 \times 8 = 64$.

In Geometrical Progression the same five things are to be observed as are in Arithmetical.

(1) The first term.
(2) The last term.
(3) The number of terms.
(4) The ratio.
(5) The sum of all the terms.

NOTE.—As the discovery of the last term in a long series of numbers is very tedious to come at by continual multiplication; therefore, for more readily finding it out, there is a series of numbers made use of in Arithmetical Proportion, called indices, beginning with a unit, whose common difference is one; whatever number of indices you make use of, set as many numbers (in such Geometrical Proportion as are given in the question) under them.

As { 1, 2, 3, 4, 5, 6, Indices
{ 2, 4, 8, 16, 32, 64, Numbers in Geometrical Progression.

But if the first term in Geometrical Progression be different from the ratio, the indices must begin with a cipher.

As { 0, 1, 2, 3, 4, 5, 6, Indices
{ 1, 2, 4, 8, 16, 32, 64, Numbers in Geometrical Progresssion.

When the indices begin with a cipher, the sum of the indices made choice of must always be one less than the number of terms given in

the question ; for 1 in the indices is over the second term, and 2 over the third, &c.

Add any two of the indices together; and that sum will agree with the product of their respective terms.

As, in the first table of indices	$2+5=7$
Geometrical progression	$4\times32=128$
In the second table	$2+4=6$
	$4\times16=64$

In any Geometrical Progression proceeding from unity, the ratio being known, to find any remote term, without producing all the intermediate terms.

Rule.—Find what figure of the indices added together would give the exponent of the term wanted ; then multiply the numbers standing under such exponent into each other, and it will give the term required.

Note.—When the exponent 1 stands over the second term, the number of exponents must be one less than the number of terms.

EXAMPLES.—XC.

(1) A man agrees for 12 peaches, to pay only the price of the last, reckoning a farthing for the first and a halfpenny for the second, &c., doubling the price to the last; what must he give for them ? *Ans.* £2 2*s.* 8*d.*

0, 1, 2, 3, 4, Exponents,
1, 2, 4, 8, 16, No. of terms.

4 + 4 + 3 = 11 (no. of terms less 1)

No.	Exp.
16 =	4
16 =	4
256 =	8
8 =	3

4)2048 = 11 (no. of farthings)

12)512

2,0)4|2.8

£2 2*s.* 8*d.*

(2) A country gentleman going to a fair to buy some oxen, met with a person who had 23; he demanded the price of them, and was answered £16 apiece. The gentleman offered £15 apiece, and he would buy all; the other told him it could not be taken; but if he would give what the last ox would come to, at a farthing for the first, and doubling it to the last, he should have them; what was the price of the oxen? *Ans.* £4369 1*s.* 4*d.*

In any Geometrical Progression not proceeding from unity, the ratio being given, to find any remote term without producing all the intermediate terms.

RULE.—Proceed as in the last, only observe that every product must be divided by the first term.

(3) A sum of money is to be divided among 8 persons, the first to have £20, the second £60, and so on in triple proportion; what will the last have? *Ans.* £43740

0, 1, 2, 3
20, 60, 180, 540 $3 + 3 + 1 = 7$, number of terms less 1

$\frac{540 \times 540}{20} = 14580$, then $\frac{14580 \times 60}{20} = £43740$ *Ans.*

(4) A gentleman dying left nine sons, to whom and to his executors he bequeathed his estate in manner following:—To his executors £50; his youngest son was to have twice as much as the executors, and each son to exceed the next younger by as much more; what was the eldest son's portion? *Ans.* £25600

The first term, ratio, and number of terms given, to find the sum of all the terms.

RULE.—Find the last term as before, then subtract the first from it, and divide the remainder by the ratio less 1; to the quotient of which add the greater, which gives the sum required.

(5) A servant, skilled in numbers, agreed with a gentleman to serve him twelve months, provided he would give him a farthing for his first month's service, a penny for the second, fourpence for the third, &c. What did his wages amount to? *Ans.* £5825 8*s.* 5¼*d.*

0, 1, 2, 3, 4
1, 4, 16, 64, 256 $4+4+3=11$. No. of terms less 1

$256 \times 256 = 65536$, then $65536 \times 64 = 4194304$

$$\frac{4194304 - 1}{4 - 1} = 1398101 + 4194304 = 5592405 \text{ farthings}$$

Ans. £5825 8*s.* 5¼*d.*

(6) A man bought a horse, and by agreement was to give a farthing for the first nail, three for the second, &c.; there were four shoes, and in each shoe 8 nails; what was the worth of the horse? *Ans.* £965114681693 13*s.* 4*d.*

(7) A certain person married his daughter on New Year's day, and gave her husband 1s. towards her portion, promising to double it on the first day of every month for 1 year; what was her portion? *Ans.* £204 15*s.*

PERMUTATION

Is the changing or varying the order of things.

Rule.—Multiply all the given terms one into another, and the last product will be the number of changes required.

EXAMPLES.—XCI.

(1) How many changes may be rung upon 12 bells; and how long would they be ringing but once over, supposing 10 changes might be rung in 1 minute, and the year to contain 365 days 6 hours?

$1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10 \times 11 \times 12 =$ 479001600 *changes, which* $\div$ 10 = 47900160 *minutes* = 91 *years*, 3 *weeks*, 5 *days*, 6 *hours*

(2) A young scholar coming to town for the convenience of a good library, asked the gentleman with whom he lodged what his diet would cost for a month, who told him £10; but the scholar not being certain what time he should stay, asked what he must give him for so long as he should be able to place his family (consisting of six persons besides himself) in different positions every day at dinner; the gentleman, thinking it would not be long, told him £5, to which the scholar agreed; what time did the scholar stay with the gentleman?

Ans. 5040 *days*

COMBINATIONS.

The Rule of Combinations shows how often a less number of things may be taken out of a greater number (all different), no regard being had to their order, and no two combinations containing exactly the same individuals.

Rule.—Take the series, 1, 2, 3, 4, &c., up to the less number given, and multiply them continually to the last product for a divisor; then take a series of as many terms, decreasing by a unit, as 10, 9, 8, 7, &c., from the greater number, and multiply them continually for a dividend; the quotient of the division will be the answer.

EXAMPLE.

A successful general was asked by his sovereign what reward he should confer on him for his services; the general requested only a farthing for every file of 10 men in a file, which he could make with a body of 100 men; what sum will it amount to?

$1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10 = 3628800$ divisor

$100 \times (100—1) \times (100—2) \times (100—3) \times (100—4) \times (100—5) \times (100—6) \times (100—7) \times (100—8) \times (100—9) = 100 \times 99 \times 98 \times 97 \times 96 \times 95 \times 94 \times 93 \times 92 \times 91 =$ 62815650955529472000 dividend; which divided, the quotient will be 17310309456440 farthings =

£18031572350 9*s.* 2*d.* *Ans.*

INTEREST, DISCOUNT, &c.

By another Method.

SIMPLE INTEREST.

Definition.—The ratio is the interest of £1 for one year at the given rate per cent., and is equal to the given rate per cent. divided by 100.

A TABLE OF RATIOS.

£3 *per cent.*	·03	£5½ *per cent.*	·055	£8 *per cent.*	·08
3½	·035	6	·06	8½	·085
4	·04	6½	·065	9	·09
4½	·045	7	·07	9½	·095
5	·05	7½	·075	10	·1

Decimals of a Year.

1 day	$= \frac{1}{365}$	of a year	= ·0027397
1 week	$= \frac{7}{365}$	of a year	= ·019178
1 month	$= \frac{1}{12}$	of a year	= ·0833
1 quarter	$= \frac{1}{4}$	of a year	= ·25
1 half	$= \frac{1}{2}$	of a year	= ·5
3 quarters	$= \frac{3}{4}$	of a year	= ·75

Hence the decimal parts of a year for any number of days, weeks, months, &c., may be discovered.

Rule.—Multiply the principal, the ratio, and the time together, and the last product will be the interest required.

EXAMPLE.—XCII.

(1) What is the interest of £945 10s. for three years, at 5 per cent. per annum?

£945·5 × ·05 × 3 = £141·825 = £141 6*s.* 6*d.* *Ans.*

(2) What is the interest of £547 14s., at 4 per cent. per annum, for 6 years? *Ans.* £131 8*s.* 11·52*d.*

Whenever there are shillings, pence, and farthings in the principal, they must be brought to the decimal of a pound.

Interest for Months.

Find the interest for one year, and take aliquot parts with the months, and add them together; or bring the months to the decimal of a year, and proceed as before.

(3) What is the interest of £236 18s. 8d. for 3 years 8 months, at 5½ per cent. per annum?

Ans. £47 15*s.* 7·55688*d.*

(4) What is the interest of £479 5s., at 5 per cent. per annum, for $5\frac{1}{4}$ years? *Ans.* £125 16*s.* $0\frac{3}{4}$*d.*

Interest for Days.

RULE.—Multiply the interest of £1 for 1 day at the given rate by the principal and the number of days.

Interest of £1 *for* 1 *Day.*

Per Cent.	*Decimals.*	*Per Cent.*	*Decimals.*
3	·00008219178	$6\frac{1}{2}$	·00017808219
$3\frac{1}{2}$	·00009589041	7	·00019178082
4	·00010958904	$7\frac{1}{2}$	·00020547945
$4\frac{1}{2}$	·00012328767	8	·00021917808
5	·00013698630	$8\frac{1}{2}$	·00023287671
$5\frac{1}{2}$	·00015068493	9	·00024657534
6	·00016438356	$9\frac{1}{2}$	·00026027397

(5) What is the interest of £240 for 120 days at 4 per cent. per annum?

·00010958904 × 240 × 120 = £3·156164352 =
£3 3*s.* 1·479444455*d. Ans.*

(6) What is the interest of £364 18s. for 154 days, at 5 per cent. per annum? *Ans.* £7 13*s.* 11·493680152*d.*

Principal, Time, and Rate per cent. given, to find the Interest and the Amount.

RULE.—Multiply the principal, the time, and ratio together, for the interest; which, added to the principal, will be the amount.

For years and days, bring the days to the decimal of a year.

(7) What will £279 12s. amount to in 7 years, at $4\frac{1}{2}$ per cent. per annum? *Ans.* £367 13*s.* 5·26*d.*

£279·6 × ·045 × 7 + £279·6 = £367·674 amount.

(8) What will £320 17s. amount to in 5 years, at $3\frac{1}{2}$ per cent. per annum? *Ans.* £376 19*s.* 11·7*d.*

Amount, Time, and Rate given, to find the Principal.

RULE.—Multiply the time by the ratio, and add a unit to the product; divide the amount by this product, and the quotient is the principal. Or divide the interest by the product of the time and ratio, the quotient is the principal.

(9) What principal being put to interest will amount to £367 13s. 5·76d. in 7 years, at $4\frac{1}{2}$ per cent. per annum?

$7 \times \cdot045 + 1 = 1\cdot315)367\cdot674(279\cdot6 = £279\ 12s.$ *Ans.*

(10) What principal being put to interest, will amount to £376 19s. 11·7d. in 5 years, at $3\frac{1}{2}$ per cent. per annum?

Ans. £320 17*s.*

When the Amount, Principal, and Time are given, to find the Rate.

RULE.—Subtract the principal from the amount, and divide the remainder by the product of the principal and time; the quotient is the rate per cent.

(11) At what rate per cent. will £279 12s. amount to £367 13s. 5·76d. in 7 years?

£367·674 − £279.6 = £88·074 *remainder.*
£279·6 × 7 = 1957·2 *product.*
88·074 ÷ 1957·2 = ·045, *or* $4\frac{1}{2}$ *per cent.* *Ans.*

(12) At what rate per cent. will £320 17s. amount to £376 19s. 11·52d. in 5 years? *Ans.* $3\frac{1}{2}$ *per cent.*

When the Amount, Principal, and Rate per cent. are given, to find the Time.

RULE.—Subtract the principal from the amount, and divide the remainder by the product of the principal and rate per cent.

(13) In what time will £279 12s. amount to £367 13s. 5·76d. at $4\frac{1}{2}$ per cent. per annum? *Ans.* 7 *years*

£367·674 − £279·6 = £88·074
£279·6 × ·045 = £12·582
£88·074 ÷ 12·582 = 7 *years.* *Ans.*

(14) In what time will £320 17s. amount to £376 19s. 11·52d. at $3\frac{1}{2}$ per cent.? *Ans.* 5 *years*

Annuities or Pensions in Arrears at Simple Interest, for Yearly Payments.

RULE.—Multiply the annuity by the square of the time, from which subtract the product of the annuity and time, and multiply half the remainder by the ratio, to which add the product of the annuity and time.

(15) If a salary of £150 be forborne 5 years at 5 per cent. per annum, what will it amount to?

£150 × 25 = 3750 £150 × 5 = 750

3750 − 750 = 3000 ÷ 2 = 1500 × ·05 = 75 + 750 = £825 *Ans.*

(16) If £250 yearly pension be in arrears 7 years, what is the amount at 6 per cent. simple interest? *Ans.* £2065

For half-yearly payments, take half the annuity, half the ratio, and twice the number of years.

For quarterly payments, take one-fourth the annuity, one-fourth the ratio, and four times the years.

COMPOUND INTEREST.

RULE.—1. Find the amount of £1 for one year, by adding 1, a whole number, to the ratio for the given rate.

2. Multiply the compound ratio, thus found, as many times into itself as years given, and the last product again by the principal.

(17) What is the amount of £225 at 5 per cent. per annum, for 3 years, compound interest?

1·05 × 1·05 × 1·05 = 1·157625 × £225 = £260·465625 = £260 9*s.* 3¾*d.* *Ans.*

(18) What will £200 amount to in 4 years, at 5 per cent. per annum? *Ans.* £243 2*s.* 0·3*d.*

EQUATION OF PAYMENTS.

RULE.—Find the present worth of each payment for its respective time.

Multiply the rate per cent. by the time, but when the time is less than 12 months, take aliquot parts from the rate, to which add 1, a whole number; then divide the payment by it, and the quotient is the present worth.

Repeat the same with each payment, and add all the present worths together; then subtract the total from the given sum, and divide the remainder by the product of the total of the present worths multiplied by the rate; the quotient will be the equated time or answer.

(19) D owes E £200, whereof £40 is to be paid at 3 months, £60 at 6 months, and £100 at 9 months; at what equated time may the whole debt be paid, rebate being 5 per cent.?

£40 : 1·0125 = 39·5061 £60 ÷ 1·025 = 58·5365
£100 ÷ 1·0375 = 96·3855
£39·5061 *From* 200·
58·5365 *Take* 194·4281
96·3855
Remains 5·5719
Total present worths £194·4281

£194·4281 × ·05 = 9·721405)5·57190000000(·57315 *time*
·57315 = 6 *months*, 26·334 *days*. *Ans.*

(20) D owes F £800, whereof £200 is to be paid at 3 months, £200 at 4 months, and £400 at 6 months; but they agreeing to make but one payment of the whole, at the rate of 5 per cent. rebate, the true equated time is required.

Ans. 4 *months*, 22·17264 *days*

DISCOUNT.

Rule.—Multiply the ratio by the time, and to the product add 1, then divide the given sum by it; the quotient will be the present worth. Subtract the given sum from the present worth, will give the discount.

(21) What is the present worth of £357 10s. to be paid 9 months hence, at 5 per cent. per annum?

·05 × ·75 + 1· = 1·0375 £357·5 : 1·0375 = 344·578 =
£344 11*s.* 6¾·168*d.* *Ans.*

(22) What is the present worth of £275 10s., due 7 months hence, at 5 per cent. per annum? *Ans.* £267 13*s.* 10·164*d.*

ANNUITIES AT COMPOUND INTEREST.

A Table showing the amount of £1 annuity for any number of years under 31, at 5 and 6 per cent. per annum.

Years.	5 *Rates.* 6		*Years.*	5 *Rates.* 6	
1	1·00000	1·00000	16	23·65749	25·67252
2	2·05000	2·06000	17	25·84036	28·21288
3	3·15250	3·18360	18	28·13238	30·90565
4	4·31012	4·37461	19	30·53900	33·75999
5	5·52563	5·63709	20	33·06595	36·78559
6	6·80191	6·97532	21	35·71925	39·99272
7	8·14200	8·39383	22	38·50521	43·39229
8	9·54910	9·89746	23	41·43047	46·99582
9	11·02656	11·49131	24	44·50199	50·81557
10	12·57789	13·18079	25	47·72709	54·86451
11	14·20678	14·97164	26	51·11345	59·15638
12	15·91712	16·86994	27	54·66912	63·70576
13	17·71298	18·88213	28	58·40258	68·52811
14	19·59863	21·01506	29	62·32271	73·63979
15	21·57856	23·27597	30	66·43884	79·05818

The above table is made thus:—Take the first year's amount, which is £1; multiply it by 1·05, to which add 1; this gives 2·05 = the second year's amount; this being also multiplied by 1·05, and 1 added, gives 3·1525 = the third year's amount, &c.

To find the Amount of an Annuity, payable yearly, the rate and time being given.

Rule.—Multiply the number in the table under the rate per cent., and opposite to the term of years, by the annuity; the product will be the answer.

(23) What will an annuity of £50 per annum, payable yearly, amount to in 4 years, at 5 per cent. compound interest?

Under 5 per cent. and opposite 4 years ... { 4·31012 / 50

215·50600 = £215 10*s.* 1·44*d.* *Ans.*

(24) What will a pension of £45 per annum, payable yearly, amount to in 5 years, at 5 per cent.?

Ans. £248 13*s.* 0·804*d.*

To find in what Time a given Sum will amount to another given Sum reckoning Compound Interest.

RULE.—Divide the latter sum by the former, and under the rate per cent. compare the quotient with the table, the nearest to which shows the time.

(25) In what time will £50 per annum amount to £215 10s. 1½d. at 5 per cent. per annum, compound interest?

50)215·50625

4·310125 in the table = 4 years. *Ans.*

(26) In what time will £45 per annum amount to £248 13s. 0·8175d., allowing 5 per cent. per annum, compound interest? *Ans.* 5 *years*

Present Worth of Annuities.

A Table showing the present worth of £1 annuity for any number of years under 31, rebate at 5 and 6 per cent.

Years.	5 *Rates.*	6	*Years.*	5 *Rates.*	6
1	0·95238	0·94339	16	10·83777	10·10589
2	1·85941	1·83339	17	11·27406	10·47726
3	2·72324	2·67301	18	11·68958	10·82760
4	3·54595	3·46510	19	12·08532	11·15811
5	4·32947	4·21236	20	12·46221	11·46992
6	5·07569	4·91732	21	12·82115	11·76407
7	5·78637	5·58238	22	13·16300	12·04158
8	6·46321	6·20979	23	13·48857	12·30338
9	7·10782	6·80169	24	13·79864	12·55035
10	7·72173	7·36008	25	14·09394	12·78335
11	8·30641	7·88687	26	14·37518	13·00316
12	8·86325	8·38384	27	14·64303	13·21053
13	9·39357	8·85268	28	14·89812	13·40616
14	9·89864	9·29498	29	15·14107	13·59072
15	10·37965	9·71225	30	15·37245	13·76483

The above table is thus made:—Divide £1 by 1·05 = ·95238, the present worth of the first year, which ÷ 1·05 = ·90703, added to the first year's present worth = 1·85941, the second year's present worth; then ·90703 ÷ 1·05, and the quotient added to 1·85941 = 2·72324, third year's present worth, &c.

To find the Present Worth of any Annuity.

RULE.—Multiply the number in the table under the rate per cent., and opposite the years given, by the annuity; the product is the present worth.

(27) What is the present worth of an annuity of £30 per annum for 7 years, at 6 per cent.?

Under 6 per cent. and opposite 7 years	5·58238
	30
	167·47140 = £167 9*s.* 5·136*d.*

(28) What is the present worth of a pension of £40 per annum, to continue 8 years, at 5 per cent.?

Ans. £258 10*s.* 6·816*d.*

Value of Annuities or Leases taken in Reversion.

RULE.—Subtract the value of the annuity to the time when the reversionary one commences from the value of the annuity for the whole time; the remainder is the answer.

(29) What is the present worth of the reversion of a lease of £40 per annum, to continue for 6 years, but not to commence till the end of 2 years, allowing 6 per cent. to the purchaser?

6 + 2 = 8

Value of annuity for 8 years, per table ...	6·20979 × 40 = 248·39160
Ditto for 2 years.....	1·83339 × 40 = 73·33560
	175·05600 =
	£175 1*s.* 1·44*d.* *Ans.*

(30) What is the present worth of an annuity of £60 per annum, to continue for 7 years, but not to commence till the end of 3 years, allowing 5 per cent. to the purchaser?

Ans. £299 18*s.* 2·256*d.*

To find the Value of a Freehold Estate, the Annual Rent being given, and the rate per cent. that is expected should be made by the Purchase.

Rule.—Divide the rent by the ratio, and the quotient is the present worth.

(31) What is the worth of a freehold estate that lets at £50 per annum, allowing 5 per cent. to the purchaser?

£50 ÷ ·05 = £1000 *Ans.*

(32) If a freehold estate of £140 per annum were to be sold, what would be the value of it, allowing 4 per cent. per annum for the purchase money? *Ans.* £3500

To know what an Estate ought to be let at per annum, to gain a certain rate per cent. for the Purchase Money.

Rule.—Multiply the sum by the ratio, and the product is the answer.

(33) If an estate be bought for £1000, and 5 per cent. is required for the money, what must be the annual rent?

£1000 × ·05 = £50 *Ans.*

(34) If a freehold estate be sold for £1250, what must be the rent, that the purchaser may have 6 per cent. per annum for his money? *Ans.* £75

To find the Value of an Annuity or Freehold, to commence after a certain number of years.

Rule.—From the value of the annuity or freehold in perpetuity take the value of it for the certain term given; the remainder will be the present value.

(35) If a freehold estate of £50 per annum, to commence

4 years hence, is to be sold, what ought it to sell for to make 5 per cent. per annum for present payment?

£50 ÷ ·05 = £1000 = value of the annuity.
3·54595 × 50 = £177·2975 = value for 4 years, per table.
£1000 − 177·2975 = 822·7025 = £822 14*s.* 0·51*d.* *Ans.*

(36) What is a freehold estate of £240 per annum worth in ready money, that is not to commence till the end of three years, allowing 6 per cent. per annum?

Ans. £3358 9*s.* 6·624*d.*

PRACTICAL QUESTIONS ON THE ELEMENTARY RULES.

ADDITION.

(1) Add 9358, 31, 195, 69129, 47839, 39174, 395, and 1854 together. *Ans.* 167975

(2) Add 731897, 3859, 7385, 189285, 679126, 289, 81394, and 389936 together. *Ans.* 2083171

(3) Add £381 10s. 9½d., £32 17s. 6d., £185 19s. 3¼d., £927 19s. 10¼d., £82 13s. 9d., and £31 8s. 3¼d. together. *Ans.* £1642 9s. 5¼d.

(4) Add £392 8s. 7¼d., £3 8s. 6d., £279 2s. 7¼d., £0 18s. 2½d., £271 19s. 5¼d., £271 10s., £398 13s. 7¼d., and £1 19s. 3¾d. together. *Ans.* £1620 0s. 2¾d.

(5) Add £731 19s. 3¼d., £381 17s. 10¼d., £374 9s. 3½d., £0 13s. 9½d., £1 19s. 8¼d., £274 10s. 2d., £1891 18s. 6¾d., £382 10s. 7¼d., and £0 19s. 5¼d. together. *Ans.* £4040 18s. 7½d.

(6) Add £3182 19s. 3¼d., £374 19s. 3¼d., £387 16s. 2d., £380 13s. 9¼d., £27 10s. 2d., £369 0s. 3d., £1 19s. 5d., £339 13s. 6½d., and 30 guineas together. *Ans.* £5096 1s. 10¼d.

(7) Add the following bills into one sum: the baker's £11 18s. 10d., the butcher's £31 18s. 6¼d., the oilman's £27 18s. 6d., the poulterer's £1 19s. 5½d., the tallow-chandler's £5 19s. 3¾d., the fishmonger's £3 9s. 9d., and the coal merchant's £31 18s. 6d. *Ans.* £115 2s. 10½d.

(8) What sum of money will discharge the following bills: carpenter's £271 18s. 9d., bricklayer's £195 18s. 7d., plasterer's £79 15s., tailor's £35 18s., linendraper's £27 19s. 6d., bookseller's £28 18s., stationer's £10 15s. 3½d., and the upholsterer's £53 18s. 9d.? *Ans.* £705 1s. 10½d.

SUBTRACTION.

(1) What is the difference between 839142 + 389274, and 518936 + 203591? *Ans.* 505889

(2) What is the difference between £387 18s. 9¼d. and £291 17s. 5½d.? *Ans.* £96 1*s.* 3¾*d.*

(3) Borrowed 1000 guineas, and paid at different times £127 18s. 7d., £231 19s. 5½d., £57 12s. 9d., and £410 19s. 6d.; what remains unpaid? *Ans.* £221 9*s.* 8½*d.*

(4) From the total of £329 10s. 8d., £191 17s. 6d., and £391 17s. 6½d., take the total of £121 16s. 3d., £87 19s. 5¼d., £21 19s. 3½d., and £127 19s. 6d. *Ans.* £553 11*s.* 2¾*d.*

(5) A servant received from his master £30 in notes, £16 8s. 6d. in cash, and was desired to discharge the following bills: £7 9s. 6d., £1 17s. 4d., £1 13s. 9½d., £5 5s., £10 8s. 9½d., 7s. 6½d., and £3 17s. 2¾d.; how much remained of the sum he was intrusted with? *Ans.* £15 9*s.* 3¾*d.*

(6) A merchant had owing to him £871 10s. 6d., and he received at different times £87 5s. 6½d., £19 10s. 9d., £386 10s., £219 15s. 10¼d., and £85 15s. 11d.; how much remains unpaid? *Ans.* £72 12*s.* 5¼*d.*

(7) A person's property amounted to, in cash, £910 10s., value of goods £319 10s. 6d., a house £730, debts due to him £380 18s. 10d.; he owed to A £173 5s. 6d., to B £235 18s. 4d., and to C 419 12s.; what is he worth? *Ans.* £1512 3*s.* 6*d.*

(8) A tradesman failing, his debts were as follows: to A £127 10s. 8½d., to B £268 15s. 10d., to C £187 16s. 8½d., to D £317 19s. 2¼d., and to E £40 10s.; his effects amounted to, in furniture, £300, stock in trade £256 12s. 6d., good debts £87 12s. 10d.; what will be the loss sustained by his creditors? *Ans.* £298 7*s.* 1¼*d.*

MULTIPLICATION.

(1) If a person has 10s. 7¾d. per day, how much is that per annum? *Ans.* £194 5*s.* 8¾*d.*

(2) A gentleman's expenses on an average amount to £1 12s. 6d. daily, and he saves £294 12s. 6d. yearly; how much is his annual income? *Ans.* £887 15*s.*

(3) What is the value of 27 pieces of Irish linen, each 26 yards, at 4s. 9½d. per yard? *Ans.* £168 3*s.* 9*d.*

(4) Having purchased the following foreign coins, viz., 75 pistoles at 17s. 6d. each, 48 dollars at 4s. 6d. each, and 127 ducats at 3s. 4d. each, for which I presented a draft for 300 guineas, what change am I to receive? *Ans.* £217 8*s.* 2*d.*

DIVISION.

(1) A person's income is £500; what is that a week?
Ans. £9 12*s.* $3\frac{1}{2}$*d.* – 40 *rem.*

(2) If 137 yards of cloth cost £185 5s. 10d., what cost 1 yard? *Ans.* £1 7*s.* $0\frac{1}{2}$*d.* – 102 *rem.*

(3) A gentleman has an income of £887 15s.; how much may he spend daily to save £294 12s. 6d. per annum?
Ans. £1 12*s.* 6*d.*

(4) A person cleared £1150 in 17 years; how much is that per annum? *Ans.* £67 12*s* $11\frac{1}{4}$*d.* – 3 *rem.*

(5) A prize of £7257 3s. 6d. is to be equally divided among 500 sailors; what is each man's share?
Ans. £14 10*s.* $3\frac{1}{4}$*d.* – 388 *rem.*

(6) 27 pieces of cloth, each 25 yards, cost £127 10s 6d.; what cost 1 yard? *Ans.* 3*s.* $9\frac{1}{4}$*d.* – 249 *rem.*

(7) A person gains £2805 in $7\frac{1}{2}$ years; what is that a day? *Ans.* £1 0*s.* $5\frac{3}{4}$*d.* – 245 *rem.*

MISCELLANEOUS QUESTIONS.

(1) What is the value of 14 barrels of soap at $4\frac{1}{2}$d. per lb., each barrel containing 254 lb.? *Ans.* £66 13*s.* 6*d.*

(2) An oilman bought 417 cwt. 1 qr. 15 lb. gross weight of train oil, tare 20 lb. per 112 lb.; how many neat gallons were there, allowing $7\frac{1}{2}$ lb. to a gallon? *Ans.* 5120

(3) What quantity of raisins can I have for £3 10*s.* if 7 lb. cost 2s. 11d.? *Ans.* $1\frac{1}{2}$ cwt.

(4) How much must I pay for 25 barrels of figs, each 3 cwt. 3 qr. 19 lb. gross, tare 17 lb. per barrel, at £2 13*s.* $5\frac{1}{4}$*d.* per cwt.? *Ans.* £251 13*s.* $7\frac{1}{4}$*d.*

(5) Bought 2 cwt. 2 qr. 24 lb. of sugar for £8 13*s* 4*d.*; at how much must I sell it per lb. to gain 2 guineas on the whole? *Ans.* $8\frac{1}{2}$*d.*

(6) What is the value of 21 hhds. of sugar, each 14 cwt. 1 qr. 26 lb. gross, tare in the whole 135 lb., tret 4 lb. per 104, at £1 18s. $3\frac{1}{2}$d. per cwt.? *Ans.* £557 13*s.* $5\frac{1}{2}$*d.*

(7) A linen-draper received from Ireland 150 pieces of cloth, each containing 25 yards, which stood him in 3s. $2\frac{1}{2}$d. per yard; what did the whole come to? *Ans.* 601 11*s.* 3*d.*

(8) A gentleman has an annuity of £700; I desire to know how much he may spend daily, that at the year's end he may have saved 150 guineas, and given to the poor 15s. 9d. per week? *Ans.* £1 7*s.* $5\frac{3}{4}$*d.*—53 *rem.*

(9) What is the interest of £563 12*s.* $6\frac{1}{2}$*d.* for 265 days, at 5 per cent. per annum? *Ans.* £20 9*s.* $2\frac{1}{4}$*d.*—345 *rem.*

(10) What is the value of 35 cwt. 1 qr. 12 lb. of currants, tare 157 lb., tret 4 lb. per 104, at £5 19s. $7\frac{1}{2}$d. per cwt.? *Ans.* £195 5*s.* $11\frac{1}{2}$*d.*

(11) If by selling cambric at 12s. 6d. per yard, I gain 25 per cent., what would be the gain per cent., at 13s. per yard? *Ans.* £30

(12) How many pairs of shoes at 5s. 9d. per pair ought to be given for $3\frac{1}{2}$ dozen pairs of stockings, at 17s. 3d. per pair? *Ans.* 126

(13) If by selling hops at £3 10s. per cwt. the gain be 30 per cent., what would be the gain per cent. if sold at £4 5s. per cwt.? *Ans.* £57 17*s.* $1\frac{1}{2}$*d.*—6 *rem.*

(14) Bought spices at £10 10s. per cwt., and sold them again at 2s. $0\frac{3}{4}$d. per lb.; what was the gain per cent.? *Ans.* £10

(15) A has raisins at $7\frac{1}{2}$d. per lb., and B cheese at 5d. per lb.; what quantity of raisins should be given for 3 cwt. 3 qr. 7 lb. of cheese? *Ans.* 2 *cwt.* 2 *qr.* $4\frac{2}{3}$ *lb.*

(16) A steeple produced on level ground a shadow 280 feet long, when my walking-stick, of 3 feet 4 inches long, by being placed upright, caused a shadow of 4 feet 9 inches; what height was the steeple? *Ans.* 196 *feet*, $5\frac{5}{6}\frac{1}{7}$ *inches*

(17) My agent sends me word he has bought goods to the value of £500 13s. 6d. upon my account; what will his commission come to at $3\frac{1}{2}$ per cent.?

Ans. £17 10*s.* $5\frac{1}{2}$*d.*—68 *rem.*

(18) What is the amount of £1000 for $5\frac{1}{2}$ years at $4\frac{3}{4}$ per cent. per annum, simple interest? *Ans.* £1261 5*s.*

(19) What cost 19 packs of cloth, each 14 pieces, and each piece 24 yards, 3 qr. 3 n., at the rate of 6s. 8d. per yard?

Ans. £2211 2*s.* 6*d.*

(20) If $\frac{2}{3}$ of an ounce cost $\frac{7}{8}$ of a shilling, what will $\frac{5}{6}$ of a pound cost? *Ans.* 17*s.* 6*d.*

(21) A has a cheese at 9½d. per lb., and B sugar at 7½d. per lb.; what quantity of cheese should be given for 5 cwt. 1 qr. 18 lb. of sugar? *Ans.* 4 *cwt.* 1 *qr.* $2\frac{8}{19}$ *lb.*

(22) A gentleman spends one day with another £1 7s. 10½d., and at the year's end lays up £340; what is his yearly income?
Ans. £848 14*s.* 4½*d.*

(23) A grocer mixed tea at 4s. 2d. per lb. with other at 5s. 4d. per lb.; how must he sell the mixture per lb. to gain 30 per cent.? *Ans.* 6*s.* $2\frac{1}{10}$*d.*

(24) How many pieces of paper, of $\frac{3}{4}$ of a yard wide and 20 feet long, will cover a room 70 feet 10 inches round, and 5 feet 9 inches high?
Ans. 9 *pieces and* $\frac{2}{4\frac{1}{5}}$ *of a piece*

(25) What will £296 10s. amount to in $17\frac{3}{4}$ years at 4½ per cent. per annum? *Ans.* £533 6*s.* 3½*d.*

(26) What is the value of 10 casks of prunes, each 3 cwt. 1 qr. 16 lb. gross, tare $17\frac{3}{4}$ lb. per cwt., tret 4 lb. per 104, at £2 15s. 10½d. per cwt.? *Ans.* £76 15*s.* 6¾*d.*

(27) A jeweller sold jewels to the value of £1200, for which he received in part 876 pistoles, at 16s. 6d. each; what sum remains unpaid? *Ans.* £477 6*s.*

(28) If 1 cwt. of cheese cost £2 2s., how much can be bought with £23 10s. 10¾d.? *Ans.* 11 *cwt.* 23 *lb.*—1456 *rem.*

(29) If I buy a yard of cloth for 14s. 6d., and sell it for 16s. 9d., what do I gain per cent.?
Ans. £15 10*s.* 4*d.*—24 *rem.*

(30) If for 2s. 7½d. I can buy 7 lb. of raisins, what quantity can I have for £1059 14s. 3d.? *Ans.* 504 *cwt.* 2 *qr.* 14 *lb.*

(31) Sold 4 hhds. of tobacco; No. 1 weighed 5 cwt. 1 qr.; No. 2, 7 cwt. 3 qr. 17 lb.; No. 3, 6 cwt. 18 lb.; No. 4, 7 cwt. 2 qr. 15 lb., at 7½d. per lb.; what do they amount to?
Ans. £94 6*s.* 3*d.*

(32) Twelve hogsheads of cider being sold for £64 12s., the gain was found to be £18 18s. 6d.; what was the prime cost per gallon? *Ans.* 1*s.* 2½*d. per gallon*

(33) A merchant in Lisbon remits to London 5325 milreis, 250 reis; how much sterling will it amount to, exchange being 5s. 6d. per milrei? *Ans.* £1464 8*s.* 10½*d.*

(34) Bought a tun of wine for £78 17s.; at what price must I sell it per quart to gain £5 10s. by the whole, when 22 gallons had leaked out?

Ans. 1*s.* 10*d. per quart,* $\frac{4}{920} = \frac{1}{230}$

(35) A tobacconist would mix 20 lb. of tobacco at 9d. per lb. with 60 lb. at 12d. per lb., 40 lb. at 18d. per lb., and 12 lb. at 24d. per lb.; what is a pound of this mixture worth?

Ans. 1*s.* 2¼*d.* $\frac{108}{132} = \frac{9}{11}$

(36) A room 30 feet long and 18 feet wide, is to be covered with painted cloth of ¾ yard wide; how many yards will cover it, and what will be the cost at 6s. 8½d. per yard?

Ans. quantity 80 *yards, and cost* £26 16*s.* 8*d.*

(37) At what rate per cent. will £956 amount to £1314 10s. in 7½ years, simple interest? *Ans.* 5 *per cent.*

(38) How many lb. of sugar at 4½d. per lb. must be given in barter for 60 gross of bottles, at 8s. 8d. per gross?

Ans. 1386 *lb.* $\frac{12}{18} = \frac{2}{3}$

(39) In 7 cheeses, each weighing 1 cwt. 2 qr. 5 lb., how many allowances for seamen, each weighing 5 oz. 7 dr.?

Ans. 3563$\frac{35}{87}$ *shares*

(40) How many planks of 15 feet long, and 15 inches wide, will floor a warehouse 60 feet 6 inches long, and 33 feet 6 inches wide? *Ans.* 108$\frac{21}{225} = \frac{7}{75}$

(41) In 3 casks of oil weighing as follows, first 4 cwt. 19 lb., second 3 cwt. 1 qr. 17 lb., third 5 cwt. 3 qr. 19 lb. how many gallons, allowing 16 lb. per cwt. tare, and 7½ lb. neat to a gallon? *Ans.* 172$\frac{12}{15}$ *gallons*

(42) What must I pay for 10 hhds. of sugar, each weighing 11 cwt. 1 qr. 27 lb., at £2 13s. 9d. per cwt.?

Ans. £308 16*s* 5¼*d.* $\frac{72}{112} = \frac{9}{14}$

(43) What is the value of 871 cwt. 3 qr. 8 lb. of sugar, at £3 17s. 9½d. per cwt.? *Ans.* £3391 0*s.* 5¼*d.*—24 *rem.*

(44) What is the value of 319 cwt. 3 qr. 17 lb. of cotton, at £3 17s. 3½d. per cwt., tare 4 lb. per cwt.?

Ans. £1192 3*s.* 1*d.* $\frac{84}{112} = \frac{21}{28}$

(45) If $\frac{5}{6}$ of a gallon cost $\frac{5}{8}$ of a pound, what will $\frac{5}{9}$ of a tun cost? £105

(46) A bankrupt's effects amounted to £3879 10s. 6d., and his creditors received 8s. 9½d. in the pound; how much did his debts amount to? *Ans.* £8825 9*s.* 2¼*d.*—138 *rem.*

(47) A vintner bought a pipe of wine at 7s. 6d. per gallon, with which he mixed a certain quantity of water, and sold the mixture at 10s. per gallon; his gain upon the whole was £19 13s.; how many gallons of water did he put in?

Ans. $7\frac{4}{5}$ *gallons*

(48) A gentleman delivered to a goldsmith 137 oz. 6 dwt. 9 gr. of silver, and ordered him to make it into tankards of 17 oz. 15 dwt. 10 gr. each; spoons of 21 oz. 11 dwt. 13 gr. per dozen; salts of 3 oz. 10 dwt. each; knives and forks of 21 oz. 11 dwt. 13 gr. per dozen together; and for every tankard to have one salt, a dozen of spoons, and a dozen of knives and forks; what number of each sort must he have?

Ans. 2 *of each sort, and* 8 *oz.* 9 *dwt.* 9 *gr. over*

(49) Bought 54 hhds. of wine at 5s. 8d. per gallon, of which I kept 3 hhds. for my own use, and sold the remainder for what the whole cost me; at how much did I sell it per gallon?

Ans. 6*s.*

(50) Bought sugar at £3 8s. 6d. per cwt., and sold it again at $10\frac{1}{2}$d. per lb.; what is the gain per cwt. and per cent.?

Ans. £1 9*s.* 6*d. per cwt.*, £43 1*s.* $3\frac{3}{4}$*d. per cent.*—54 *rem.*

(51) Bought 274 yards of cloth for £217 9s. 9d., half of which cost 14s. 6d. per yard; what did the remainder cost me per yard? *Ans.* 17*s.* 3*d.*

(52) The sum of £1000 is to be divided among 3 men in such a manner that if A has £3, B shall have £5, and C £8; how much must each receive?

Ans. A £187 10*s.*, *B* £312 10*s.*, *C* £500

(53) What must I pay for 179 cwt. 1 qr. 13 lb. of sugar, at £2 8s. $6\frac{1}{4}$d. per cwt.? *Ans.* £435 2*s.* $11\frac{3}{4}$*d.* $\frac{65}{112}$

(54) If a piece of wainscoting be 8 feet $6\frac{1}{2}$ inches long, and 2 feet $9\frac{3}{4}$ inches broad; what is the superficial content, and the value of it at $10\frac{1}{2}$d. per foot?

Ans. 24 *feet* 0 *in.* 3 *p.*; *value* £1 1*s.*—126 *rem.*

(55) A draper bought 28 pieces of stuffs at £4 per piece; he sold 10 of them at £4 6s. each, and 8 at £4 8s. each; how must he sell the remainder to gain 10 per cent. by the whole quantity? *Ans.* £4 10*s.*

(56) Laid out £150 10s. in wine, at 4s. 3d. a gallon, some of which received damage in carriage, and I sold the rest at

5s. 9d. per gallon, which produced only £97 10s. 6d.; what quantity was damaged? *Ans.* 369 *gallons*

(57) What is the interest of £320 10s. for 258 days, at 5 per cent. per annum? *Ans.* £11 6*s.* 6½*d.*—62 *rem.*

(58) What is the interest of £842 from the 6th of March to the 24th of June the same year, at 3½ per cent. per annum? *Ans.* £8 17*s.* 7½*d.*—20 *rem.*

(59) How many yards of cloth, at 17s. 6d. per yard, can I have for 13 cwt. 2 qr. of wool, at 14d. per lb.

Ans. 100 *yards*, 3 *qr.* ½

(60) Bought 58 yards of linen, at 15½d. per yard, which I sold for £4 16s. 8d.; what did I gain per yard? *Ans.* 4½*d.*

(61) Sold a quantity of goods standing me in £3 15s. at one time for £4 10s., and the like quantity at another time for £5; what difference of gain per cent. does it make?

Ans. £13 6*s.* 8*d.*

(62) A gentleman has an annuity of £864 10s.; I desire to know how much he may spend daily, that at the year's end he may lay by 100 guineas, and give to the poor 10s. 6d. per week? *Ans.* £2 0*s.* 1¼*d.*—287 *rem.*

(63) What is the interest of £3591 10s. 8d. for 219 days, at 4½ per cent. per annum? *Ans.* £96 19*s.* 5*d.*—146 *rem.*

(64) A merchant bought a parcel of jewels for £220 ready money, and sold them again for £440, payable at the end of 6 months; what did he gain thereby, allowing 6 per cent. per annum discount? *Ans.* £207 3*s.* 8½*d.*

(65) A stone measures 4 feet 6 inches long, 2 feet 9 inches broad, and 3 feet 4 inches deep; how many solid feet does it contain, and what is the value of it at 9½d. per foot?

Ans. content 41 *feet* 3 *in.; value* £1 12*s.* 7¾*d.*—6 *rem.*

(66) A has 648 yards of cloth at 14s. per yard ready money, but in barter will have 16s.; B has wine at £42 per tun ready money; I demand the price of the wine in barter, and how much must be given for the cloth?

Ans. £48 *the tun, and* 10 *tuns*, 3 *hhds.* 12 *gallons of wine must be delivered in barter*—576 *rem.*

(67) A gentleman in his will left £50 to the poor, and ordered that ⅓ should be given to old men, to have 5s. each; ¼ to poor women, to have 2s. 6d. each; ⅕ to poor boys,

to have 1s. each; $\frac{1}{6}$ to poor girls, to have 9d. each; and the remainder to the person who distributed it; I demand how many of each description there were, and how much the person who distributed the money had for his trouble.

Ans. 66 *men*, 100 *women*, 200 *boys*, 222 *girls, and the person had* £2 13*s.* 6*d. for his trouble*

(68) A delivers to B 5 cwt. 2 qr. 10 lb. of rice, at $3\frac{1}{2}$d. per lb., one-third of which is to be paid in ready money, and the remainder in linen, at 2s. $8\frac{1}{2}$d. per yard; how much linen must B give A? *Ans.* 44 *yds.* 3 *qr.* 3 *n.*—18 *rem.*

(69) A merchant bought 400 pieces of cloth at £12 per piece, which he shipped for Spain, and to have returns from thence, one-half in wine, at £30 per pipe, and the other half in rice, at 28s. per cwt.; I demand how much of each he is to receive.

Ans. 80 *pipes of wine;* 1714 *cwt.* 1 *qr.* 4 *lb. of rice*

(70) Gave $30\frac{1}{2}$ yards of satin, at 18s. 4d. per yard, for 6 cwt. 1 qr. 20 lb. of tobacco; how much was the tobacco valued at per lb.? *Ans.* $9\frac{1}{4}$*d.*—20 *rem.*

(71) Of a piece of cloth, containing 20·125 yards, a part was sold for £5·46; what quantity remained, supposing the whole to be worth £18·35? *Ans.* 14·13686 *yards*

(72) How many ingots of silver, each 7 oz. 19 dwt. 13 gr., at 4s. $9\frac{1}{2}$d. per ounce, may be bought for 500 guineas?

Ans. 274

(73) What is the discount of £125 for 21 days, at 5 per cent. per annum? *Ans.* 7*s.* 2*d.*—66 *rem.*

(74) Shipped 305 casks of butter, weighing 546 cwt. 2 qr. 14 lb., which cost me £2 7s. 6d. per cwt.; paid for duty 7d. per cwt., cooperage £2 15s. $9\frac{1}{2}$d., boat hire 15s., porterage, &c., £11 19s. 6d., warehouse-room £3 1s. 6d.; what does the butter stand me in when on board?

Ans. £1332 15*s.* 4*d.*

(75) A mercer bought $3\frac{1}{2}$ pieces of silk, each containing $24\frac{2}{3}$ ells, at 6s. $0\frac{3}{4}$d. per ell; how much did they cost?

Ans. £26 3*s.* $4\frac{3}{4}$*d.*

(76) A grocer mixed 3 cwt. 2 qr. of sugar at 5d. per lb. with 5 cwt. 1 qr. 24 lb. at $4\frac{1}{4}$d. per lb.; what is the value of this mixture per cwt.? *Ans.* £2 2*s.* $4\frac{3}{4}$*d.*—188 *rem.*

(77) A bankrupt is indebted to A £317 19s., to B £217

10s., to C £186, to D £74 9s.; his estate is worth only £349 18s.; how must it be divided?

Ans. A's share £139 15*s.* 7*d.*— 8952 *rem.*
B's share £95 12*s.* 4½*d.*— 5508 *rem.*
C's share £81 15*s.* 4¾*d.*—15798 *rem.*
D's share £32 14*s.* 7¼*d.*— 1578 *rem.*

(78) What is the compound interest of £860 for 2 years, at 4¾ per cent. per annum, the interest payable half-yearly?

Ans. £84 13*s.* 1¼*d.*

(79) Bartered 127 pieces of cloth for 3589 ells of holland, at 7s. 11d. per ell English; what was the value of the cloth per piece? *Ans.* £11 3*s.* 8½*d.*—94 *rem.*

(80) In 3 hhds. of sugar, weighing as follows—the first 3 cwt. 2 qr. 18 lb. gross, tare 67 lb.; the second 3 cwt. 1 qr. 19 lb. gross, tare 53 lb.; and the third 3 cwt. 1 qr. 19 lb. gross, tare 49 lb., and allowing tret to each as usual—what is the neat weight and the value of the whole, at £2 10s. 9d. per cwt.?

Ans. 8 *cwt.* 2 *qr.* 17 *lb. neat; value* £21 19*s.* 0¾*d.*—84 *rem.*

(81) A and B trade together; A puts in £320 for 5 months, B £460 for 3 months, and they gained £100; what must each man receive?

Ans. A £53 13*s.* 9¾*d.*—186 *rem.*; *B* £46 6*s.* 2*d.*—112 *rem.*

(82) Sold goods amounting to £700, to be paid at two 4 months; what is the present worth at 5 per cent.?

Ans. £682 19*s.* 5½*d.*

(83) If by selling 1 cwt. of sugar for £1 13s. 4d. the gain be 6s. 8d., what is the gain on 3 cwt. 2 qr. 20 lb., and how much per cent.? *Ans.* £1 4*s.* 6¼*d.*—16 *rem. gain, and* £25 *per cent.*

(84) Bought 27 bags of ginger, each weighing gross 84¾ lb., tare 1⅜ lb. per bag, tret 4 lb. per 104 lb.; what do they come to at 8½d. per lb.? *Ans.* £76 13*s.* 2¾*d.*—2 *rem.*

(85) Shipped for Jamaica 550 pairs of stockings at 11s. 6d. per pair, and 460 yards of cotton at 14d. per yard, in return for which I had 46 cwt. 3 qr. of sugar at 24s. 6d. per cwt., and 1570 lb. of indigo at 2s. 4d. per lb.; what balance remains due to me? £102 12*s.* 11½*d.*

(86) A merchant, with a stock of £575, gains £150 in 10 months; how much will he gain with a stock of £1500 in 16 months? *Ans.* £626 1*s.* 8¾*d.*—275 *rem.*

(87) A person bought a quantity of serge and lining for £61 9s. 2d.; there were 236 yards of serge, at 3s. 4d. per yard, and for every 2 yards of serge he had 3 yards of lining; how many yards of lining had he, and what did it cost per yard? *Ans.* 354 *yards, at* 15*d. per yard*

(88) A draper bought a piece of cloth at 3s. 2d. per yard, and sold one-third of it at 4s., one-fourth at 3s. 8d., one-fifth at 3s. 6d., and the remainder at 3s. 4d. per yard; his gain upon the whole was 15s. 2d.; how many yards did the piece contain, and what was his gain per cent.?

Ans. 30 *yards; gain per cent.* £15 19*s.* 3½*d.*—30 *rem.*

(89) A person bought 360 yards of cloth, consisting of two sorts, for £331 4s.; the quantity of the worst sort was to that of the best as 2 to 3, and the price of the best to that of the worst per yard as 5 to 4; I demand the quantity of each, and the prices per yard.

Ans. 144 *yards at* 16*s., and* 216 *yards at* 20*s. per yard*

(90) A person bought two parcels of goods, that weighed together 9 cwt. 3 qr. 16 lb., which cost £97 17s. 6d.; their difference in weight was 1 cwt. 2 qr. 16 lb., and of price £8 13s. 3d.; each respective weight and value is required; also how much each parcel cost per lb.

Ans. Greater parcel 5 *cwt.* 3 *qr.* 2 *lb., which cost* £53 5*s.* 4½*d.; or,* 1*s.* 7¾*d. per lb.*—104 *rem.*

Less parcel, 4 *cwt.* 0 *qr.* 14 *lb., which cost* £44 12*s.* 1½*d.; or,* 1*s.* 11*d. per lb.*—318 *rem.*

THE END.

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